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Trouble-shooting instructions : REN-5001
 BOSCH system : VE..F.. pump
 Make of vehicle : RENAULT
 Basic microcard : FZD-00.

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1.SPECIAL FEATURES

* This microcard contains the trouble-shooting instructions, valid at the time of publication, for the following Renault models with diesel engine J8S 2.0 L 48 kW (65 bhp) and 65 kW (88 bhp):

Renault R 21 D (03.86->)
 Renault R 21 TD (03.86->)

2. TEST SPECIFICATIONS

2.1 Idle speed:
 R 21 D 700...800 min -1
 R 21 D-Turbo 700...750 min -1

2.3 Coordination, pump - engine:
 2.3.1 Testing/adjusting "static"
 Engine position: Cyl. 1 at TDC

Check value:
 Pump position: 0.68...0.72 mm after BDC

Setting:
 Pump position: 0.70 mm after BDC

2.3.2 Testing "dynamic"
 At idle speed
 Start of injection 13.5° before TDC

2.4 Compression: 20 to 30 bar

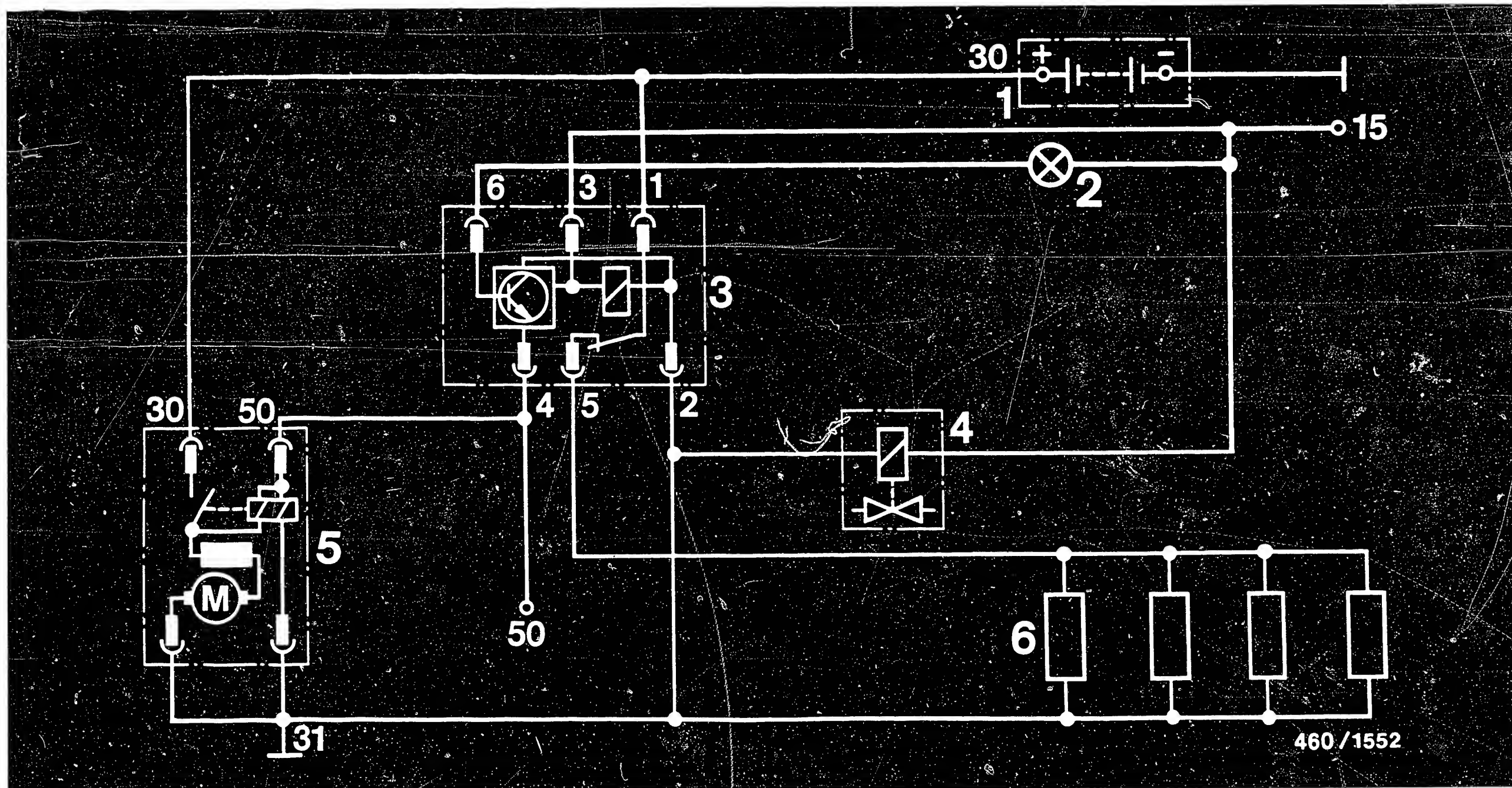
2.5 Charge-air pressure: 0.6 bar

2.6 Toothed-belt tension
 Scale interval 14...15

2.7 Tightening torques

Injection-pump gear (hexagon nut)	50 Nm
Fuel lines	25 Nm
Fastening screws of injection pump	25 Nm
Screw plug	10 Nm
Nozzle-holder assembly	17 Nm
Angle bracket of injection pump	25 Nm
Hollow screws, fuel lines	25 Nm
Sheathed-element glow plugs	40 Nm

For production reasons:
continued on the following
coordinate.



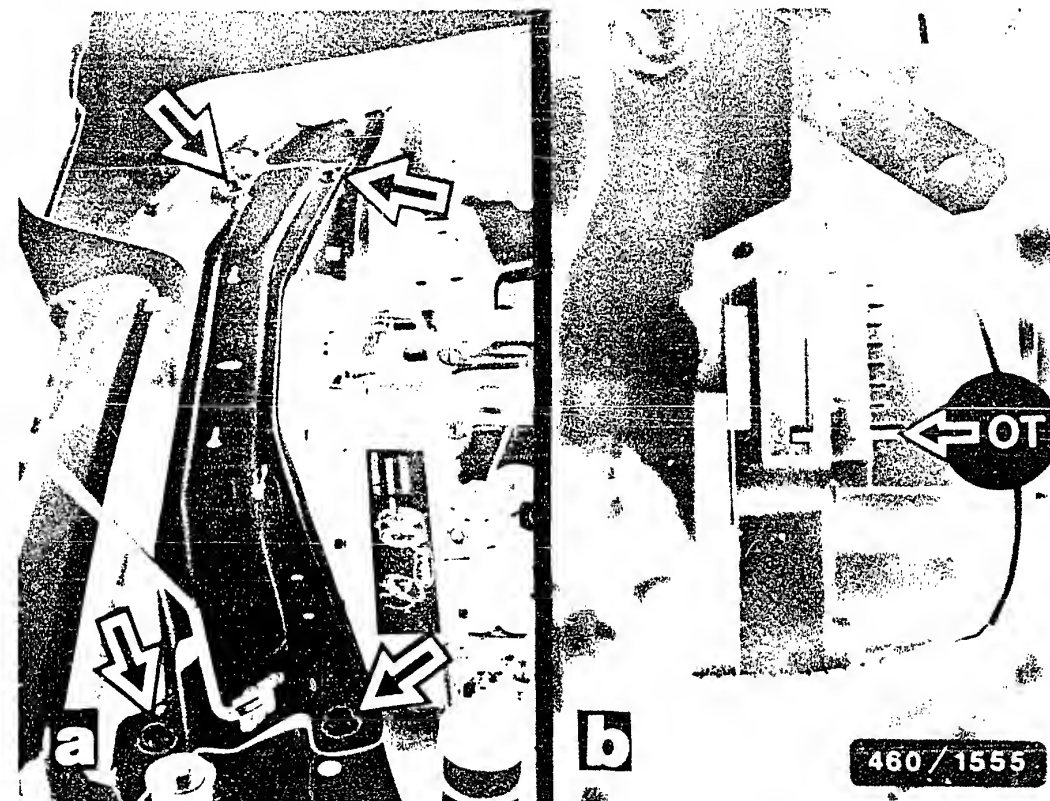
1 = Battery
 2 = Preheating repeater lamp
 3 = Glow-time control unit

4 = Solenoid-operated valve
 5 = Starting motor
 6 = Sheathed-element glow plugs

3. TERMINAL DIAGRAM FOR PREHEATING SYSTEM

4. TOOLS

Description	Part number	Application
Puller	KDEP 1118	Pulling off injection-pump gear
Setting mandrel	KDEP 1123	Locking crankshaft
Holding device	KDEP 1124	For securing pump-drive gear
Measuring tool	KDEP 1085	Coordination, pump - engine
Toothed-belt tester	KDEP 1121	Checking toothed-belt tension
Pressure gauge 0...1.6 bar	KDJE-P 100 or e.g. Wilka No.4184	Checking charge-air pressure
Box wrench	KDEP 1115	Loosening/tightening fuel-injection tubing



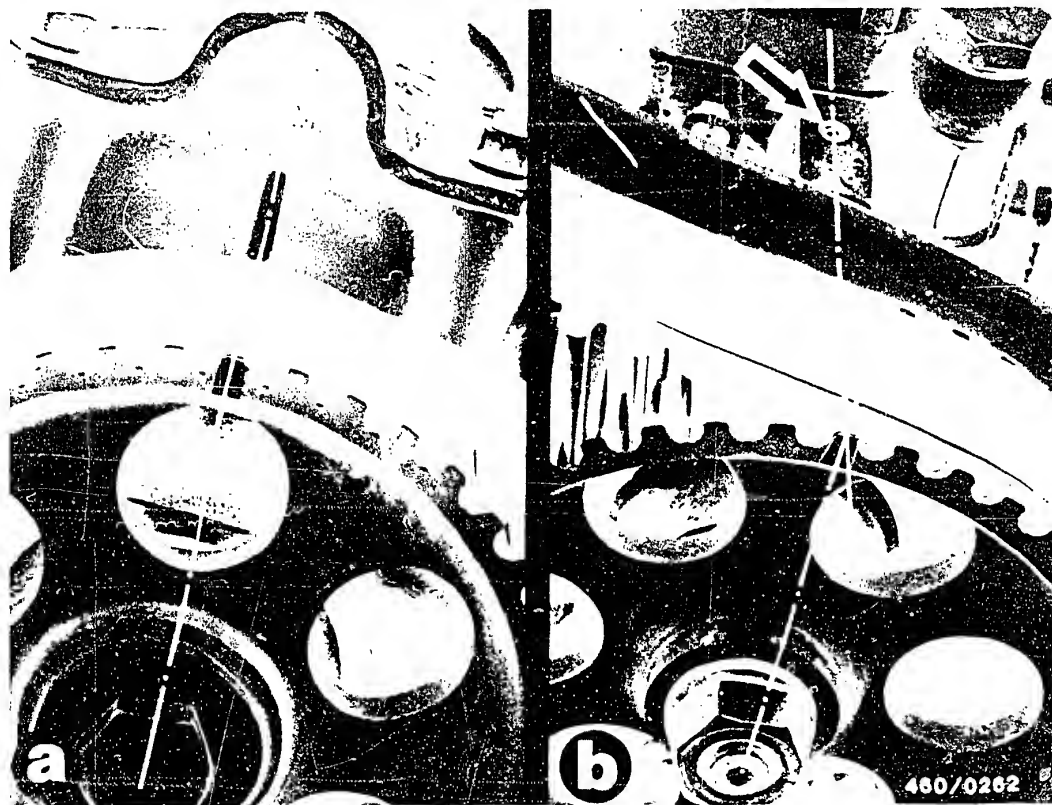
5. REMOVING INJECTION PUMP

Disconnect negative cable at battery.

Remove cross strut above the radiator (illustration a - arrows), V-belt from generator and power-steering pump as well as toothed-belt protective cover.

4. Shift into gear and chock up left-hand front wheel.

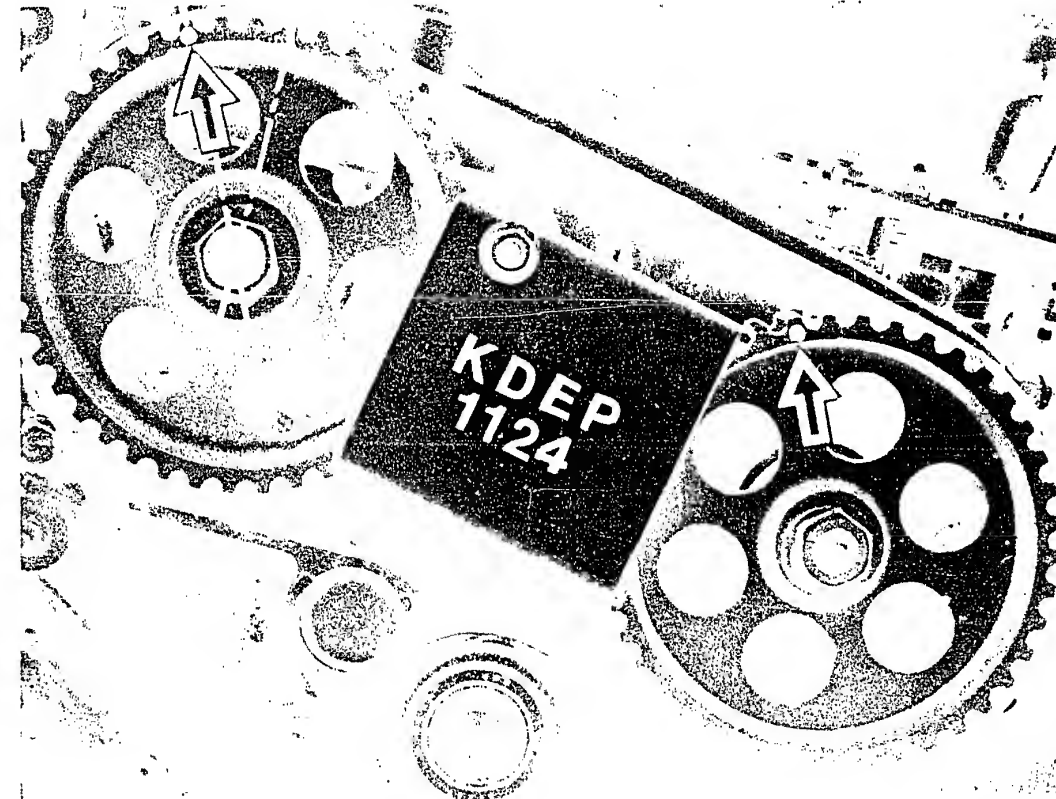
By turning the front wheel, turn the crankshaft to TDC of cylinder 1 (illustration b).



In this engine position, test the position of the timing gears:

The marking on the camshaft gear must be aligned with the center axis of the valve cover (Figure a).

The marking on the pump drive pinion will then be pointing to the center axis of the governor-shaft (arrow, Figure b).



Turn the camshaft back until the marking on the camshaft gear is three teeth ahead of the TDC marking on the valve cover.

Insert holding device KDEP 1124 between the camshaft gear and pump drive pinion and fasten it in this position (see illustration).

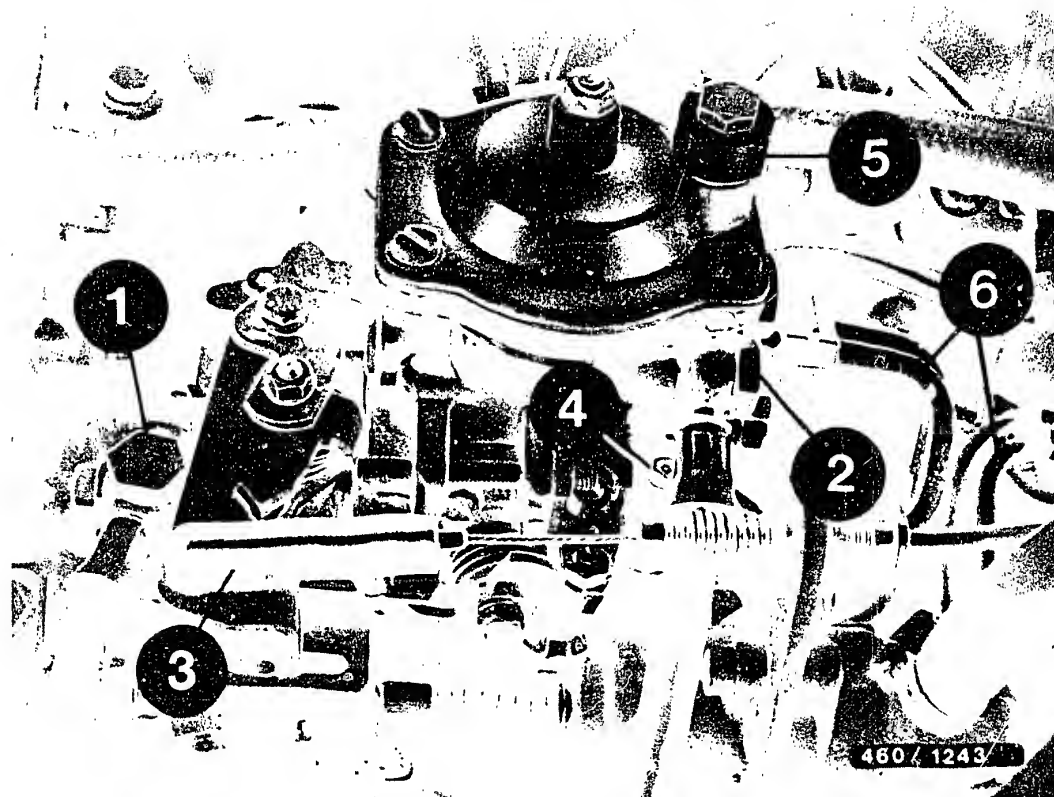
Loosen the fastening nut on the fuel-injection-pump pinion and unscrew it about 2 turns.

Use puller KDEP 1118 to loosen the injection-pump pinion from the cone of the input shaft.

Remove the fastening nut and washer.

N o t e :

Do not remove the toothed belt from the timing gear.

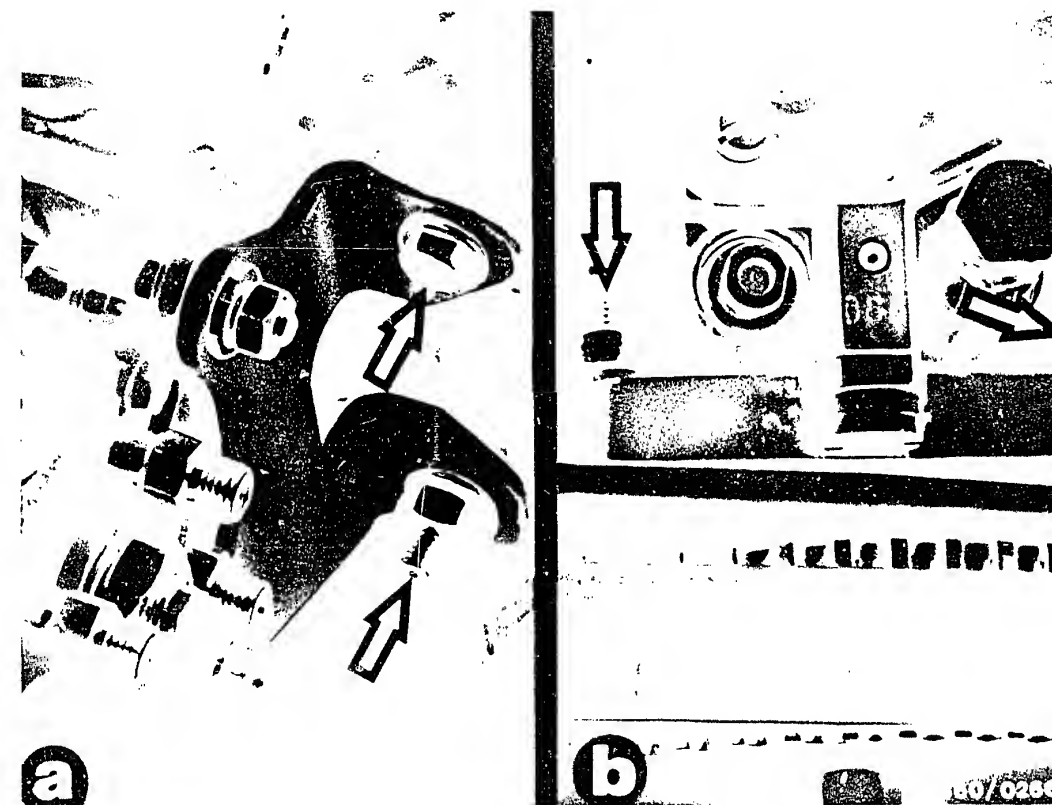


- 1 = Fuel supply line
- 2 = Fuel return line
- 3 = Bowden cable to control lever
- 4 = Connection cable to ELAB
- 5 = Charge-air-pressure connection
(R 21 D-Turbo)
- 6 = Fuel-injection tubing

Remove the bowden cable at the control lever of the fuel-injection pump, the connecting cable to the electric shutoff device, fuel lines, and charge-air-pressure connection if present. (Prevent loosening of the delivery-valve holders by counterholding)

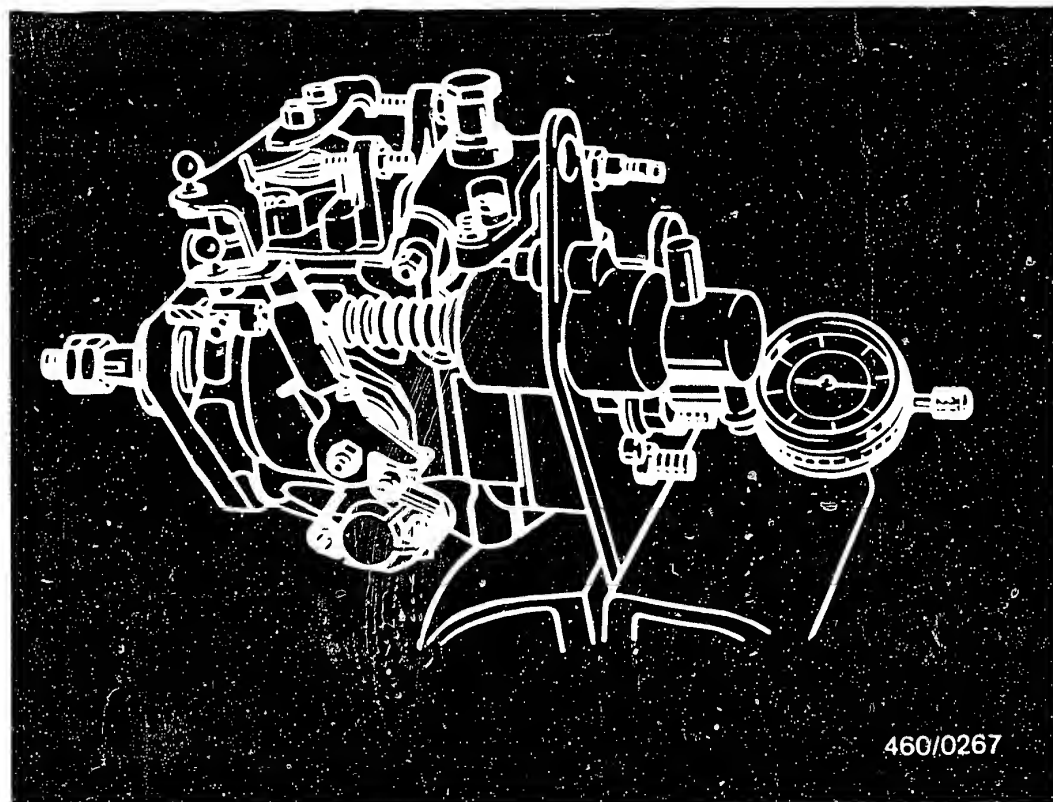
Pinch off coolant hoses a short distance after the expansion elements of the idle increase using commercially-available spring clips.

Loosen hose clamps and remove coolant hoses.



Unscrew the fastening screws of the injection-pump angle bracket (arrows, illustration a).

Remove the fastening screws of the injection pump at the pump flange (arrows, illustration b) and remove the injection pump from the engine.



6. INSTALLING INJECTION PUMP

Clamp injection pump in vice (see illustration).

Screw two hexagon nuts on to drive shaft of injection pump and lock.

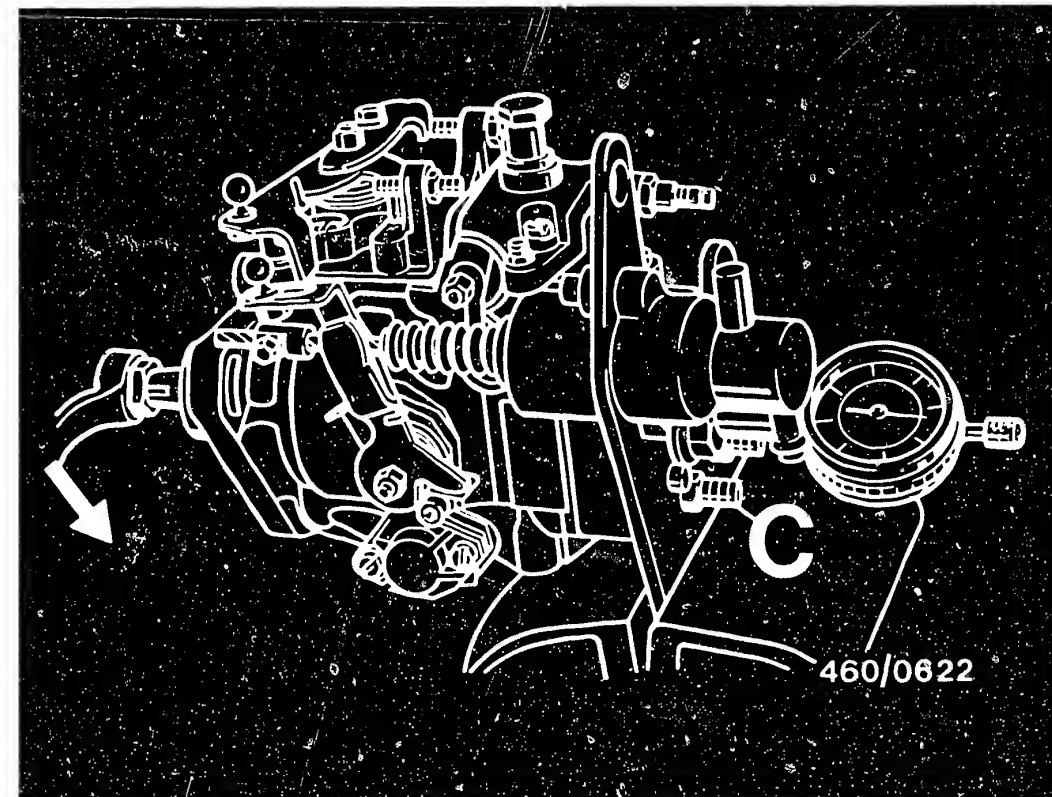
Remove bleeder screw of injection pump.

Mount measuring tool KDEP 1085 into thread bore of bleeder screw.

Mount dial indicator 1 687 233 011 with measuring foot into measuring tool KDEP 1085 (see illustration).

N o t e :

When testing and adjusting the start of delivery, the cold-start injection advance must be in neutral position.

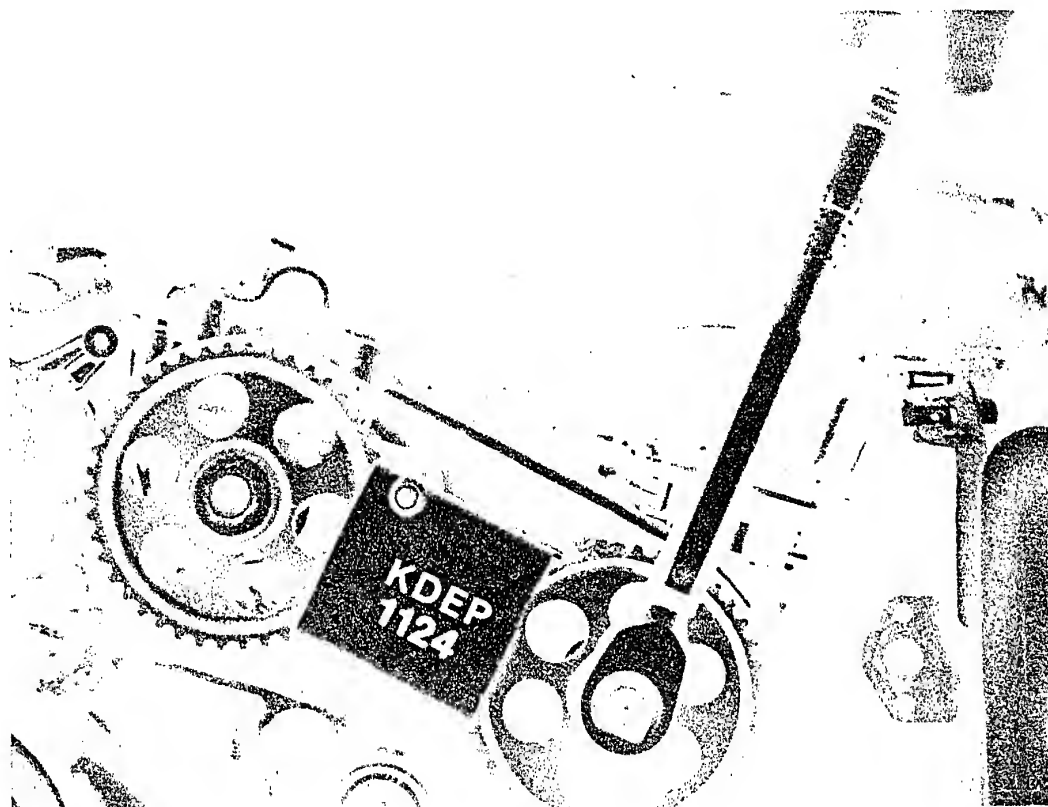


Turn pump shaft in direction of arrow until distributor-pump plunger reaches BDC.

In this position, preload dial indicator approx. 3mm and set to "0".

Turn drive shaft further in direction of arrow until the keyway (once more at BDC of distributor-pump plunger) points to outlet "C" (see illustration) of distributor head.

Unscrew hexagon nuts (do not turn drive shaft any more).



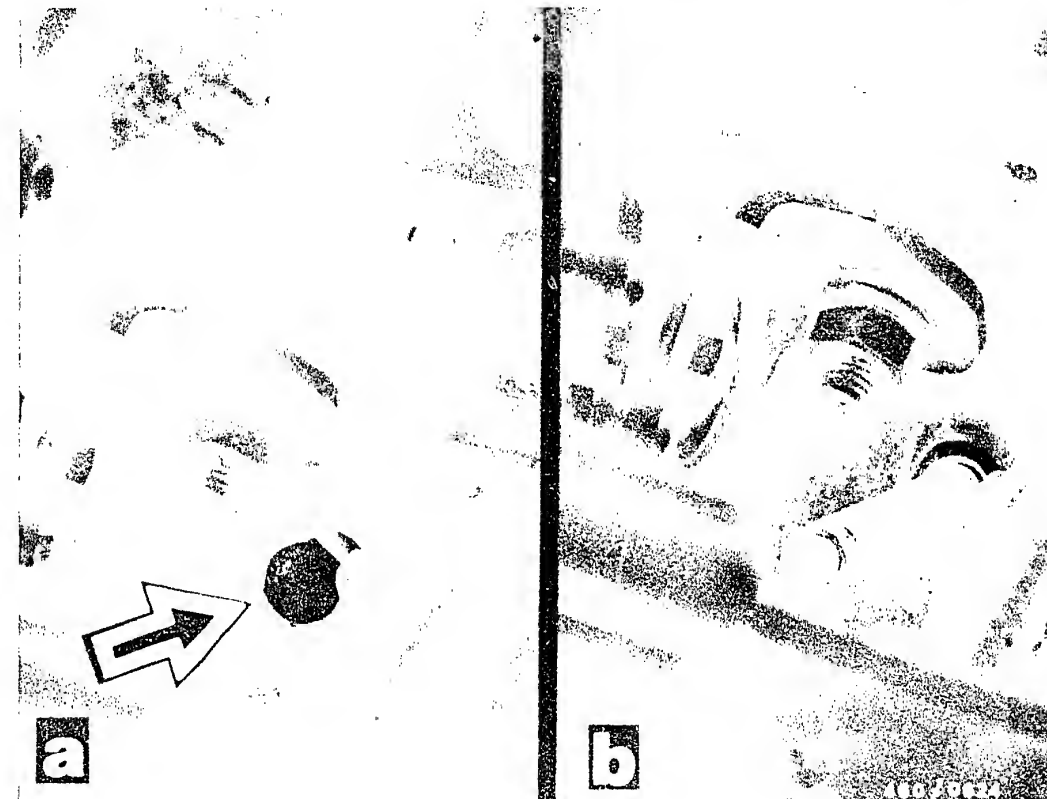
Insert Woodruff key into slot of drive shaft.

Guide injection pump into bore of pump drive gear.

Screw on fastening nuts of injection pump by hand.

Mount washer and fastening nut of pump drive gear and tighten to 50 Nm.

Remove holding device KDEP 1147.



Turn crankshaft in direction of engine twice.

At TDC of cylinder 1, lock crankshaft using setting mandrel KDEP 1123.

To do this, unscrew screw plug at engine block (near to injection pump) (arrow, illustration a) and insert setting mandrel (illustration b).

In this position, dial indicator at injection pump must indicate a plunger lift of 0.70 mm after BDC.

If necessary, correct by pivoting the injection pump.

N o t e :

Poor tensioning of the toothed belt adversely affects the pump setting.

Test toothed-belt tension using belt-tension testing tool KDEP 1121.

Turn vernier sleeve until the lower edge of the sleeve is aligned with the marking on the measuring tongue.

Read off measurement.

Setting: Scale interval 14...15

Checking the setting

Remove setting mandrel KDEP 1123.

Turn crankshaft 1 3/4 revolutions in direction of rotation.

Check whether dial indicator is at "0" at BDC of distributor-pump plunger.

Turn crankshaft further until TDC (engine) and lock using setting mandrel KDEP 1123.

Dial indicator at injection pump must indicate a plunger lift of 0.68...0.72 mm.

Check the position of the timing gears at this engine position:

Marking at camshaft gear must coincide with the center axis of the valve cover.

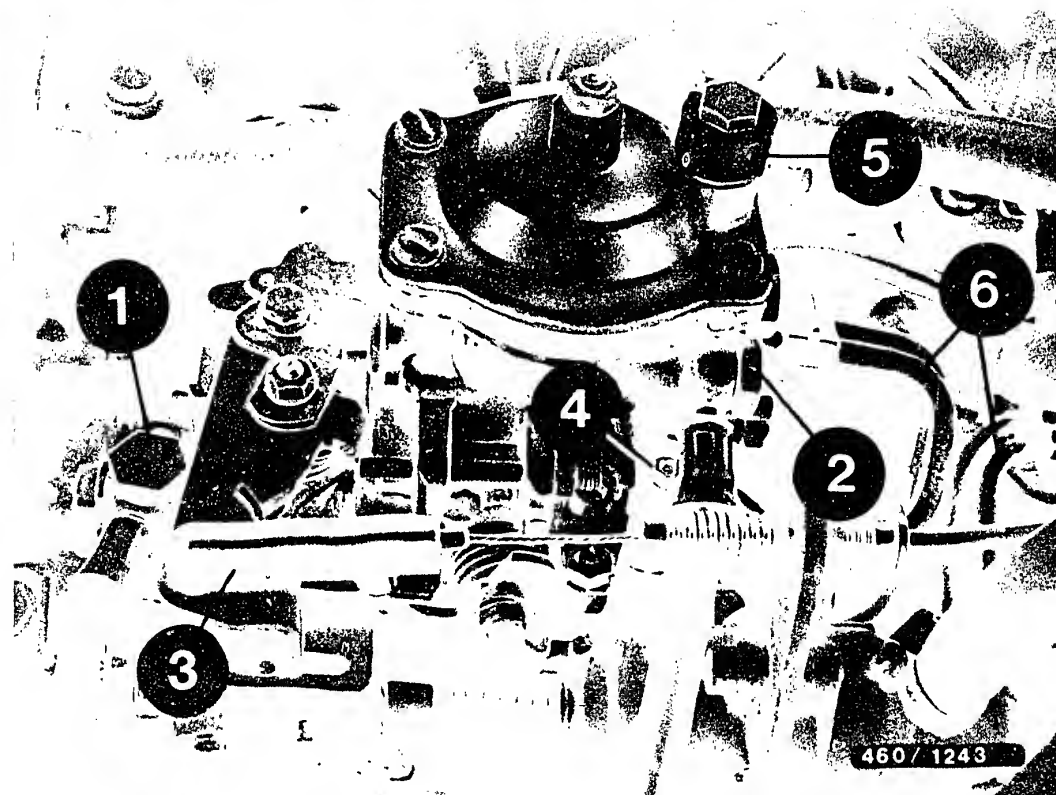
Marking of the pump drive gear points at the same time to the center axis of the governor-axle bore.

Remove setting mandrel KDEP 1123.

Tighten fastening nuts of injection pump to 25 Nm.

Remove measuring tool KDEP 1085 with dial indicator and mount bleeder screw with new copper seal ring.

Mount angle bracket at distributor head of injection pump and tighten fastening screw.

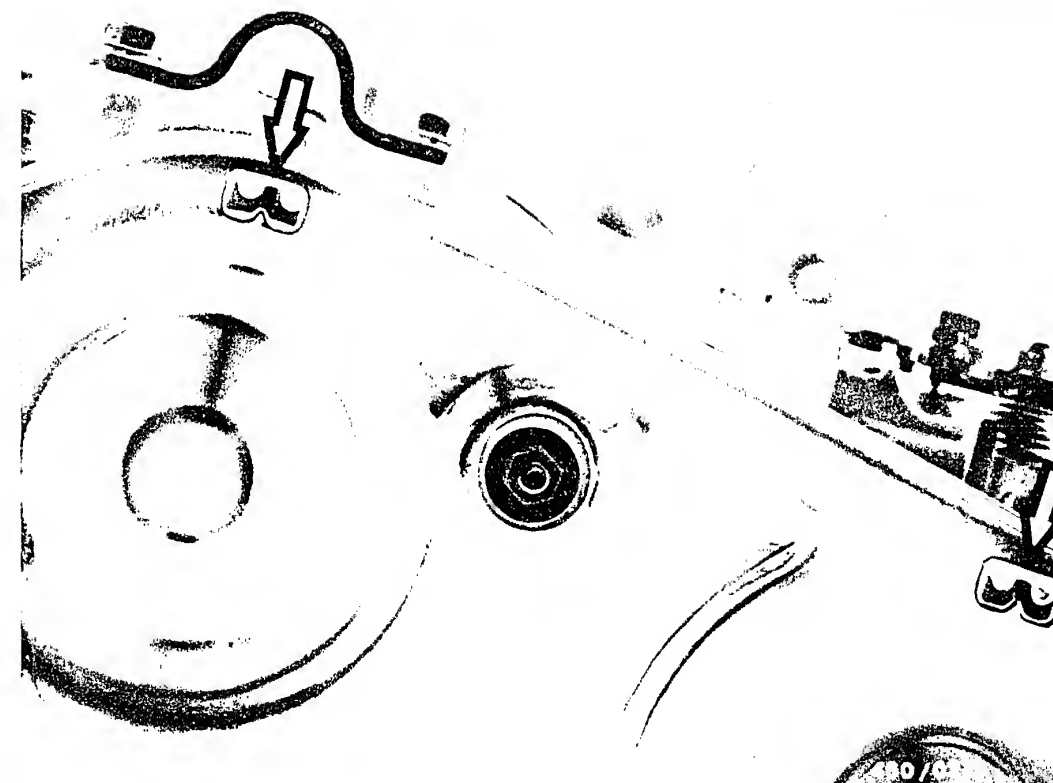


- 1 = Fuel supply line
- 2 = Fuel return line
- 3 = Bowden cable to control lever
- 4 = Connection cable to ELAB
- 5 = Charge-air-pressure connection
(R 21 D-Turbo)
- 6 = Fuel-injection tubing

Connect bowden cable to control lever of fuel-injection pump, the connection cable to the electric shutoff device, fuel lines, and the charge-air-pressure connection if present. (Prevent the delivery-valve holders from turning by counterholding)

Connect coolant hoses to the expansion element of the idle increase, and the negative cable to the battery.

Mount the toothed-belt protection cover, V-belt, and transverse support.



7. TESTING AND ADJUSTING ENGINE TIMING

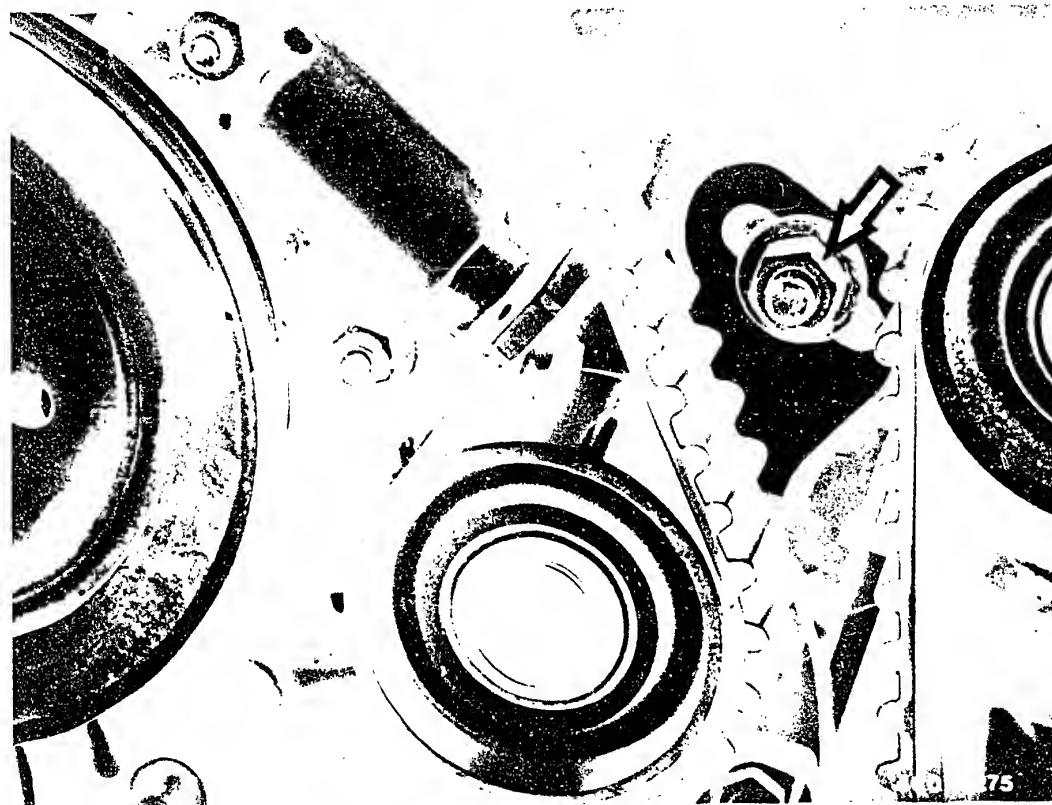
7.1 TESTING ENGINE TIMING

Engage 4th gear and lift front left wheel.

Turn camshaft to TDC of cylinder 1 (by turning front wheel), and hold in this position with setting mandrel KDEP 1123.

Check to see whether markings on the camshaft and fuel-injection-pump gears are in alignment with the needles of the adjustment windows (see illustration).

If these markings are not aligned with their reference marks, adjust engine timing.



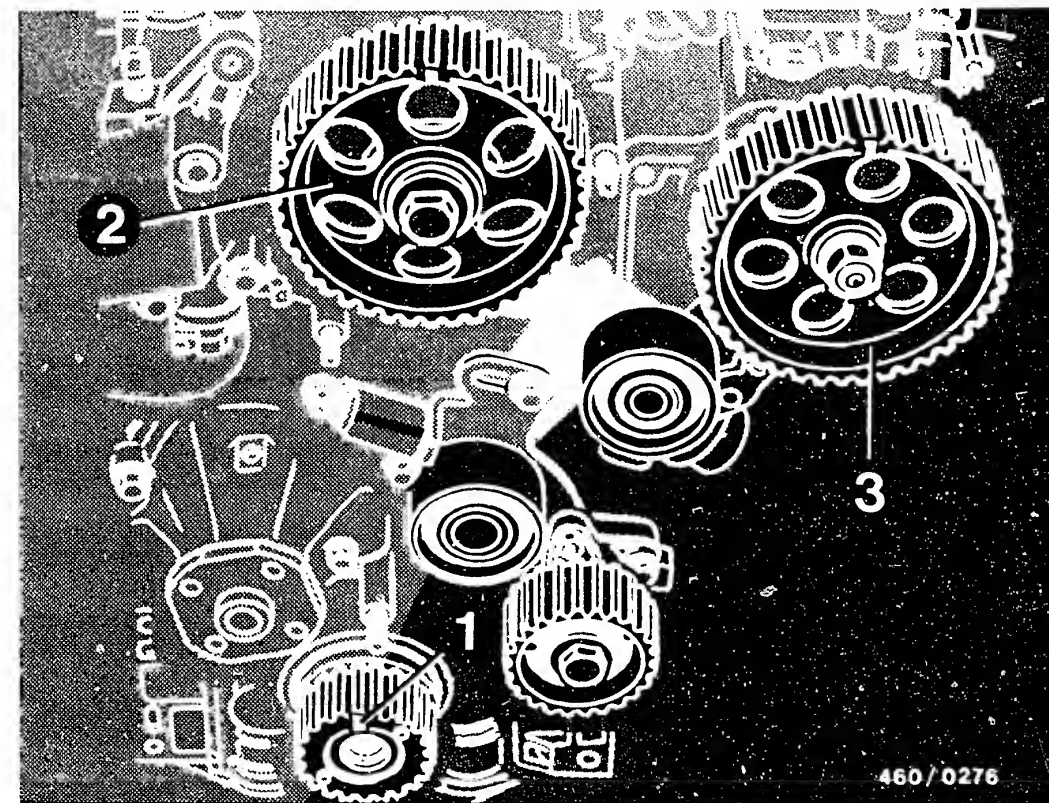
7.2 ADJUSTING ENGINE TIMING

Remove the transverse support above the radiator, the V-belt, and toothed-belt cover.

Loosen the fastening nut of the tensioning-wheel bracket (arrow).

Push the tensioning wheel against the spring tensioner and tighten fastening nut.

Remove toothed belt.



- 1=Crankshaft gear
- 2=Camshaft gear
- 3=Pump drive pinion

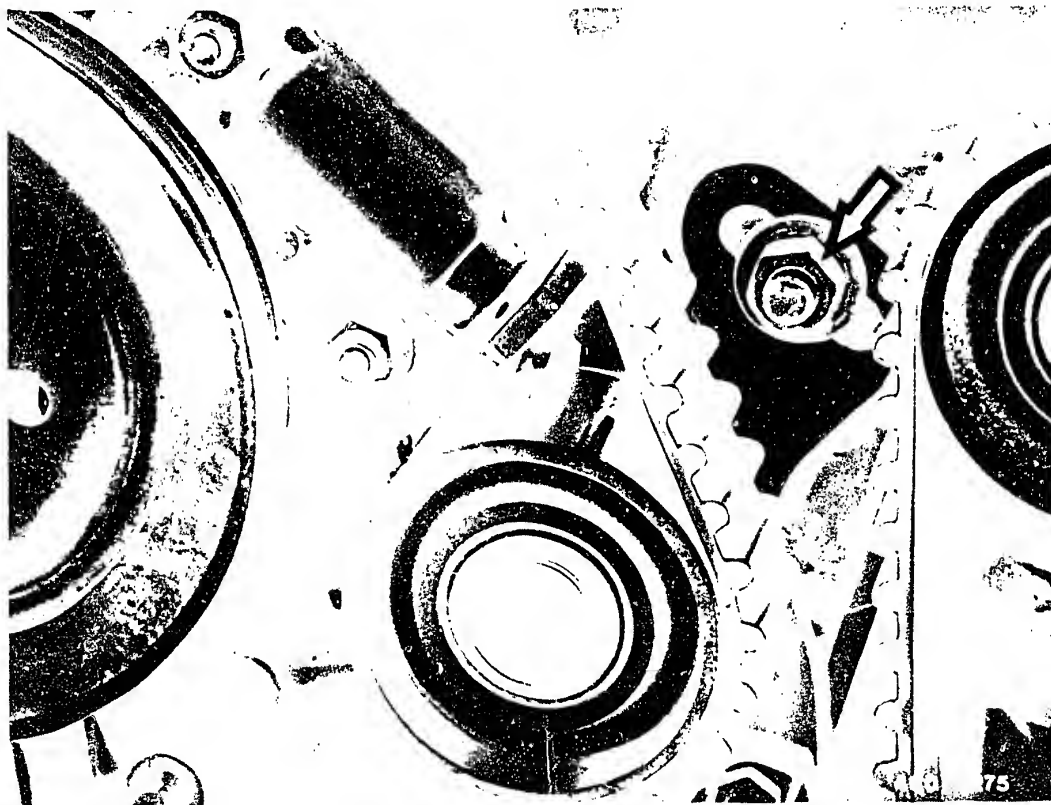
The marking on the crankshaft gear must point upwards.

Turn the camshaft gear so that the marking of the camshaft gear is in alignment with the center axis of the valve cover.

The marking on the pump drive pinion will then point to the center axis of the governor-shaft hole.

Note :

By temporarily positioning the toothed-belt cover, the correct position of the camshaft gear and the drive pinion of the fuel-injection pump can be checked through inspection holes.



Mount the toothed belt without changing the positions of the drive gears.

Loosen the fastening bolt of the tensioning-wheel bracket.

Remove setting mandrel KDEP 1123.

Turn the crankshaft two complete turns in the direction of engine rotation until the markings are aligned again.

Tighten the fastening bolt of the tensioning-wheel bracket.

Use belt-tension tester KDEP 1121 to check toothed-belt tension.

Target value: scalar value 14...15

Mount the toothed-belt cover, V-belt, and transverse support.

Check/adjust the coordination of the fuel-injection pump and the engine.

7. TESTING CHARGE-AIR PRESSURE

When working on the turbo-supercharger, keep in mind that even the tiniest contamination particles can cause irreparable damage to the supercharger.

For this reason, never operate the engine without air filter.

Pressure-measuring device KDJE-P 100, or a 0 ... 1.6 bar pressure gauge (e.g. Wika no. 4184) can be used to test charge-air pressure.

7.1 Measuring charge-air pressure

The charge-air pressure is measured under full load, ideally on a chassis dynamometer, at 2250...2750 min⁻¹ in the range from 80 ... 100 km/h in 5th gear.

Read charge-air pressure from pressure gauge.

Target value: 0.6 bar

N o t e :

Evaluation of the exhaust turbo-supercharger requires that start of delivery and nozzle-opening pressure be correctly set, there be no leakage in the air-induction or exhaust systems, and that the engine be in good mechanical condition (valve clearance, compression).

If the charge-air-pressure control valve is defective, replace the exhaust turbo-supercharger.

After installation of a new exhaust turbo-supercharger, fill the supercharger with oil and let the engine idle about 1 minute in order to ensure oil supply to the charger.

Trouble-shooting instructions : VWW-5013
BOSCH system : VE pump VE..E..
Make of vehicle : VW
Basic microcard : FZD-00..

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SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following VW / AUDI models:

* Engine: 1.6 L Code letters RA : 59 kW
JR/MF: 51 kW
* Engine: 1.3 L : 33 kW

Note on engine 1.6 L:

The fuel-injection system differs as follows from that of the 1.6 L engine:

- Idle increase coupled with timing device KSB
- Mechanical power on/off damper
- Spring-actuated power on/off damper

STRUCTURE, USAGE

These brief instructions essentially comprise vehicle-specific special features and test specifications (set values).

In line with the customer complaint, the trouble-shooting chart indicates various causes/component faults.

Detailed information on trouble-shooting can be obtained from the trouble-shooting chart in the basic instructions.

NOTE:

The set values and special features in these vehicle-related brief instructions are always binding even if reference is made to basic instructions.

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty (warm and cold)
2. Engine hunts when idling/engine speed too high
3. Rough idling with warm engine
4. High fuel consumption in conjunction with inadequate engine power and formation of smoke
5. Inadequate performance
6. Black fumes in full-load range in conjunction with hard engine running, possible loss of power
7. Hard engine running

Cause (component fault)

*	*			*						Tank empty, tank ventilation
*		*								Injection sequence not firing sequence
	*			*						Inlet/return hollow screws
*										Shutoff device
	*			*						Air in fuel system
	*									Paraffin separation
										Leak in fuel lines
*				*						Fuel lines clogged
*				*						Supply lines clogged
				*						Engine air filter
	*									Idle speed
*										Residual-quantity setting
*	*			*		*				Injection nozzle

B03



TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1. Starting motor operates, engine fails to start or starts only with difficulty (warm and cold)
2. Engine hunts when idling/engine speed too high
3. Rough idling with warm engine
4. High fuel consumption in conjunction with inadequate engine power and smoke formation
5. Inadequate performance
6. Black fumes in full-load range in conjunction with hard engine running, possible loss of power
7. Hard engine running

Cause (component fault)

*										Glow plug system
*				*						Fuel filter
				*	*	*				Timing device
*	*									Engine compression
				*	*	*	*			Pump - engine assignment
				*	*	*				Engine management

B04



Customer complaint (fault symptoms)

9. Engine cannot be shut off

10. Incorrect engine speeds

11. Engine won't rev up when cold

12. High idle or rough engine running at high engine speed, poor throttle take-up

13. Black fumes in full-load range

14. White fumes in full-load
| range

Cause (component fault)

Tank empty, tank ventilation

Injection sequence not firing sequence

Inlet/return hollow screws

Shutoff device

Air in fuel system

Paraffin separation

Leak in fuel lines

Fuel lines clogged

Supply lines clogged

Engine air filter

Idle speed

Residual-quantity setting

Injection nozzle

Customer complaint (fault symptoms)

9. Engine cannot be shut off

10. Incorrect engine speeds

11. Engine won't rev up when cold

12. High idle or rough engine running at high engine speed

13. Black fumes in full-load range

14. White fumes in full-load range

Cause (component fault)

Fuel filter	
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Timing device

Engine compression

Pump - engine assignment

Engine management

TEST SPECIFICATIONS Engine 1.6 L

Idle speed:

Audi 80/Audi 90 as of model 87

Naturally aspirated engine	850...900 min ⁻¹
Turbo Diesel	920...980 min ⁻¹
Turbo Diesel with charge cooling Code letters "RA"	870...930 min ⁻¹

VW Passat as of model 88

Turbo Diesel	870...930 min ⁻¹
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Nozzle-opening pressure:	
- New nozzles	155...163 bar
- Wear limit	140 bar

Pump - engine assignment:

Setting:	
* Engine setting TDC:	Cyl. no. 1
* Pump setting after BDC:	0.98...1.02 mm

Test specification:	
* Engine setting TDC:	Cyl. no. 1
* Pump setting after BDC:	0.93...1.07 mm

Toothed belt tension	
Scale value	12...13

Charge-air pressure:	0.64...0.76 bar
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Blow-off-valve pressure	0.81...0.86 bar
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TEST SPECIFICATIONS (CONTINUED) Engine 1.3 L

Idle speed:

Polo as of model 87

Naturally aspirated diesel	850...950 min ⁻¹
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Nozzle-opening pressure:	
- New nozzles	130...138 bar
- Wear limit	120 bar

Pump - engine assignment:

Setting:	
* Engine setting TDC:	Cyl. no. 1
* Pump setting after BDC:	1.03...1.07 mm

Test specification:	
* Engine setting TDC:	Cyl. no 1
* Pump setting after BDC:	0.98...1.12 mm

Compression:	
- New	34 bar
- Wear limit:	25 bar
- Max. perm. pressure difference:	5 bar

Toothed belt tension:	
* Crankshaft sprocket, camshaft sprocket and coolant pump impeller	

Scale value:	17...18
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Tension by turning coolant pump.	
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TIGHTENING TORQUES

Engine 1.6 L

Camshaft sprocket	45 Nm
Injection pump impeller	45 Nm
Fuel lines	25 Nm
Fuel-injection-pump fastening screws ..	25 Nm
Sheathed-element glow plugs (with and without annular orifice):	
Thread M 12 x 1.25	15...25 Nm
Thread M 12 x 1	10...15 Nm

Connecting thread, sheathed-element
glow plugs:

Thread M5	5 Nm
Thread M4	2.5 Nm

Engine 1.3 L

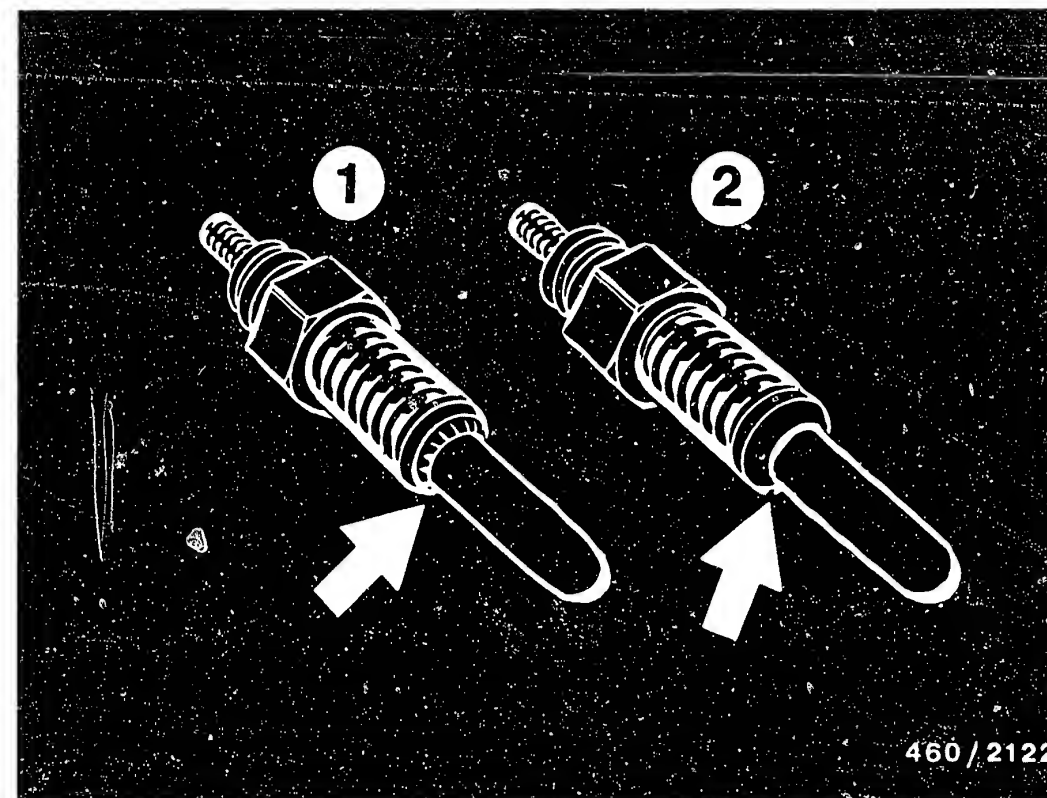
Injection pump impeller	45 Nm
Driving gear for fuel-injection pump .	100 Nm

Fastening screw

Toothed belt sprocket	90 Nm
Camshaft sprocket	45 Nm
Fuel-injection tubing	25 Nm
Injection nozzles	70 Nm

Fastening screws

Fuel-injection pump	25 Nm
Bleeder screw	15 Nm



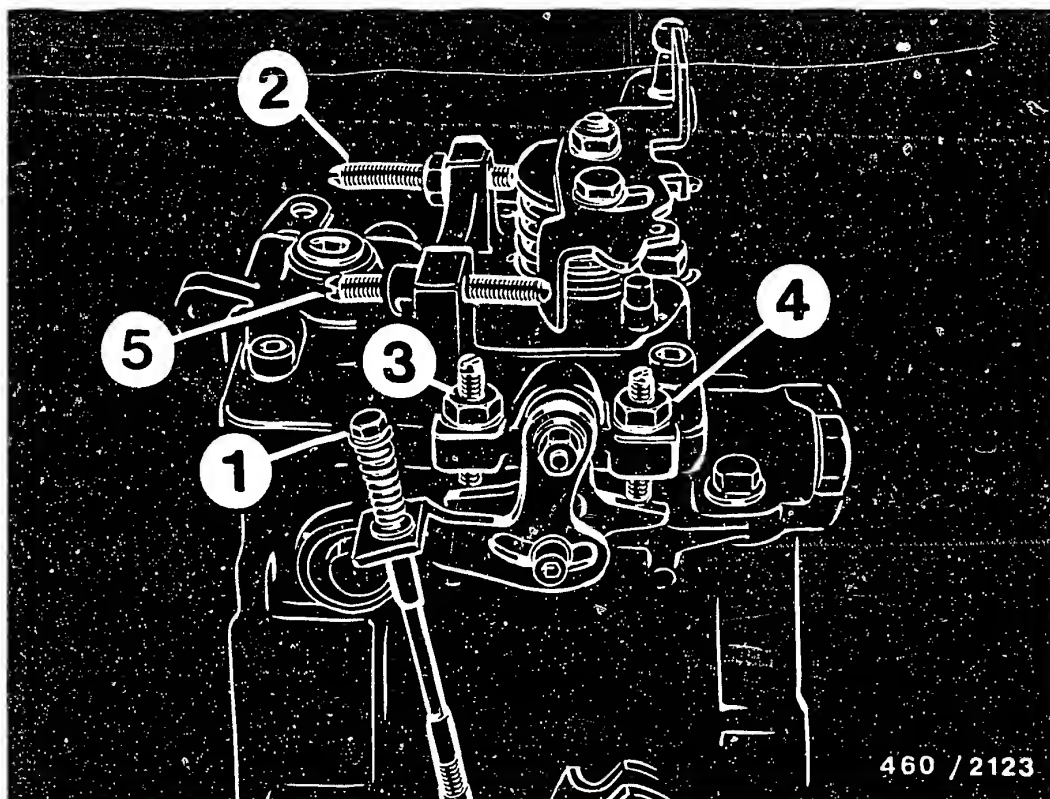
1 = Annular orifice approx. 0.5 mm

2 = Annular orifice closed

NOTE ON SHEATHED-ELEMENT GLOW PLUGS:

The tightening torque for the sheathed-element glow plugs must not be exceeded, since otherwise the annular orifice between glow bar and thread section is closed (arrows).

A closed annular orifice results in premature failure of the sheathed-element glow plugs.
(Temperature increase due to short-circuit)



460 / 2123

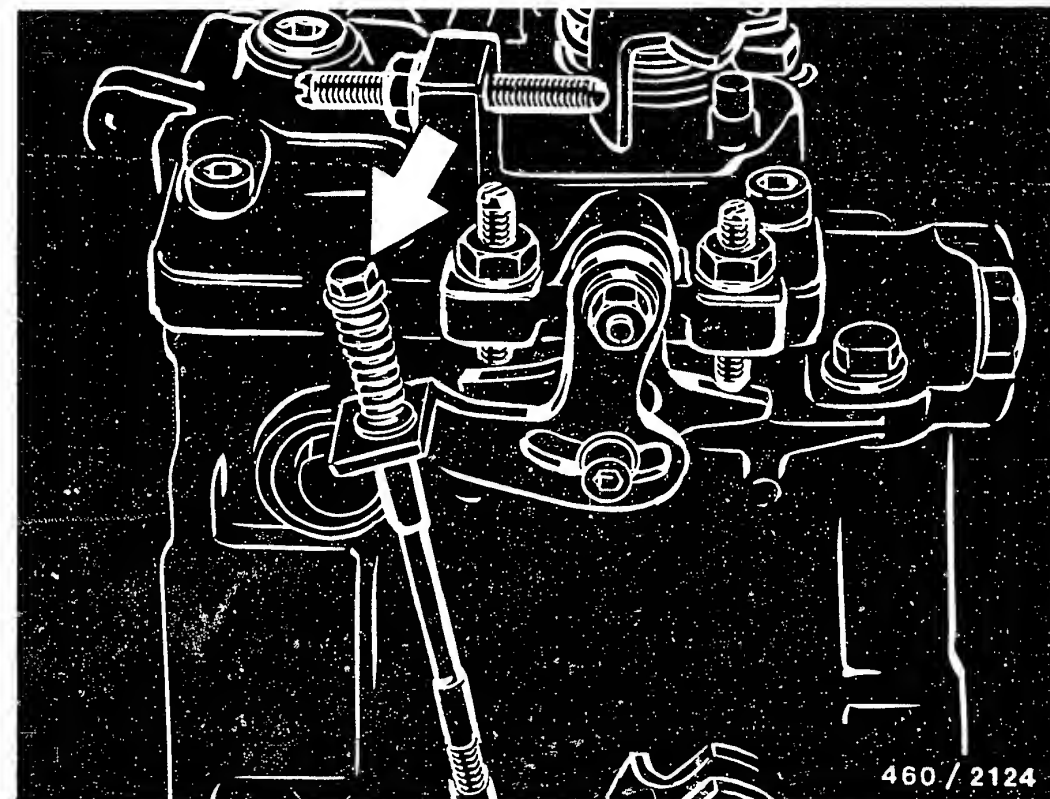
- 1 = Idle-speed adjusting screw
- 2 = Rated-speed adjusting screw
- 3 = Stop screw for low idle
- 4 = Stop screw for high idle
(speed increase)
- 5 = Residual-quantity adjusting screw

TESTING IDLE SPEED AND SPEED INCREASE

Engine 1.6 L

Testing and adjustment conditions:

- * Engine oil temperature min. 60° C
- * Cable of cold-start accelerator must not have been pulled.
- * Electrical loads off



460 / 2124

TESTING IDLE SPEED

Engine 1.6 L

Start engine and run it at idle speed.

Set engine speed at idle-speed adjusting screw (arrow).

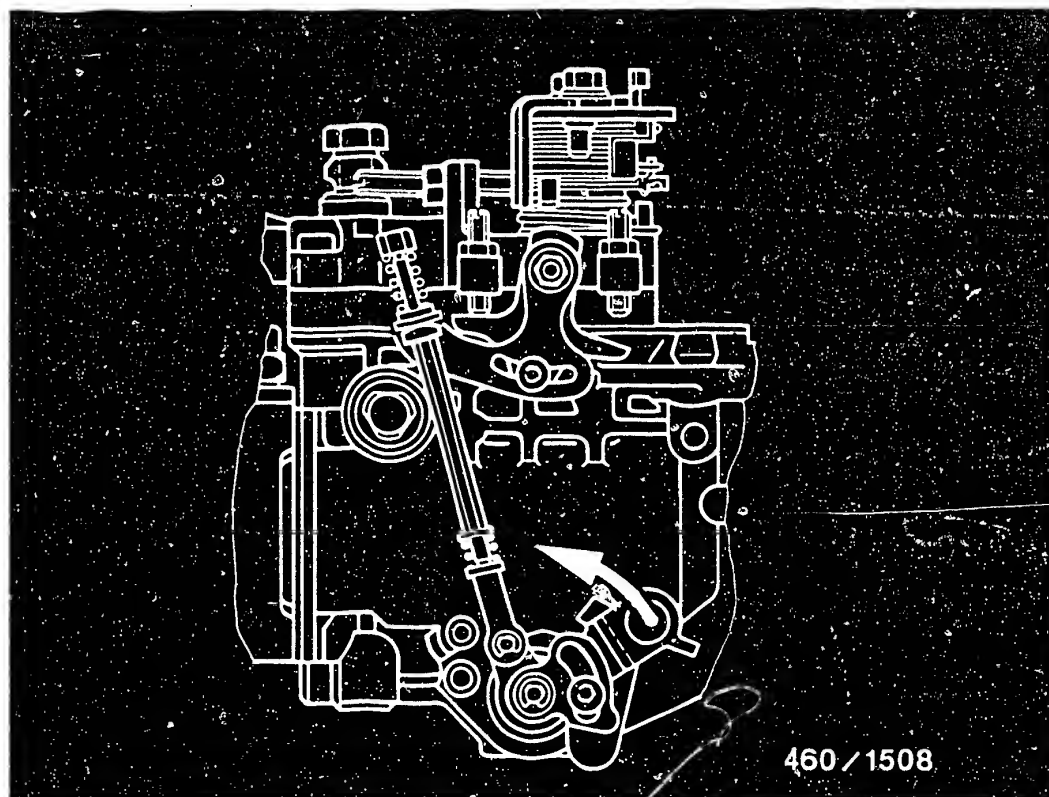
Idle speeds, engine 1.6 L:

Audi 80/Audi 90 as of model 87

Naturally aspirated diesel	850...900 min ⁻¹
Turbo Diesel	920...980 min ⁻¹
Turbo Diesel with charge cooling Code letters "RA"	870...930 min ⁻¹

VW Passat as of model 88

Turbo Diesel	870...930 min ⁻¹
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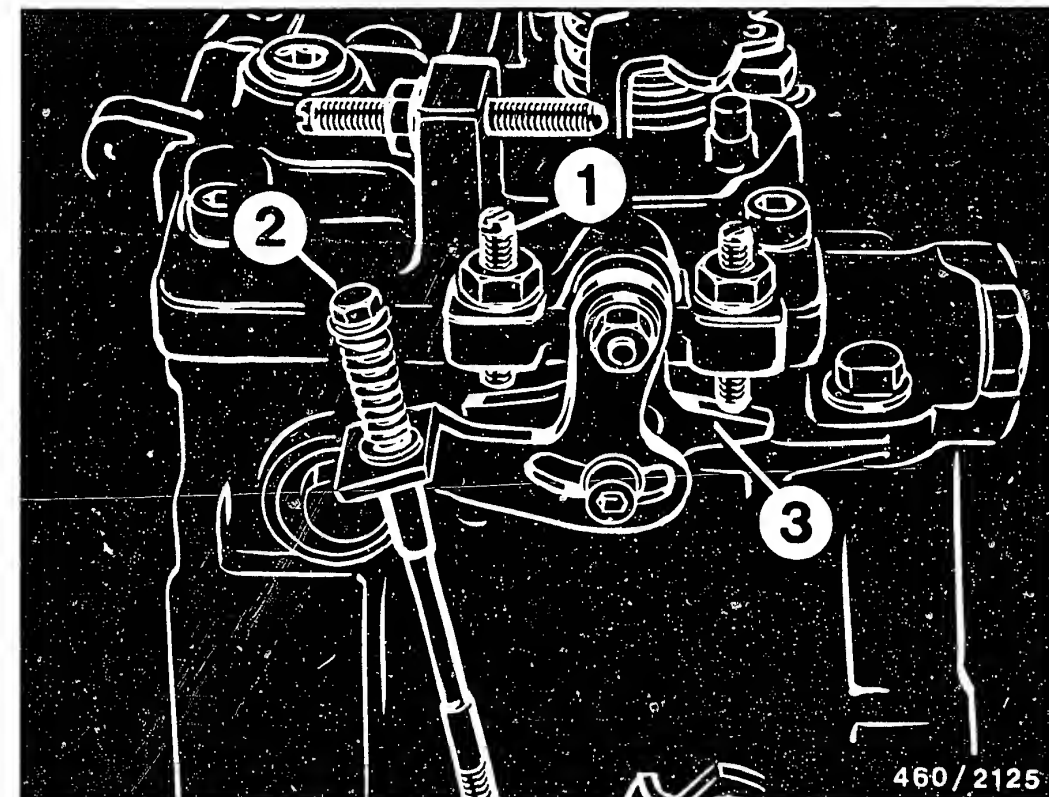


TESTING SPEED INCREASE

The speed increases by approx. 60 min⁻¹ on 1st-stage actuation of cold-start accelerator (KSB)

The speed must increase to 1000...1100 min⁻¹ with KSB completely pulled.

If the idle speed cannot be adjusted as described, since the LFG stop lever is in contact with the idle stop screw, or if the high idle speed is not correct, basic adjustment is to be performed.



- 1 = Idle stop screw
- 2 = Idle-speed adjusting screw
- 3 = LFG stop lever

ADJUSTING IDLE SPEED

* LFG stop lever is in contact with idle stop screw.

Turn back idle stop screw.

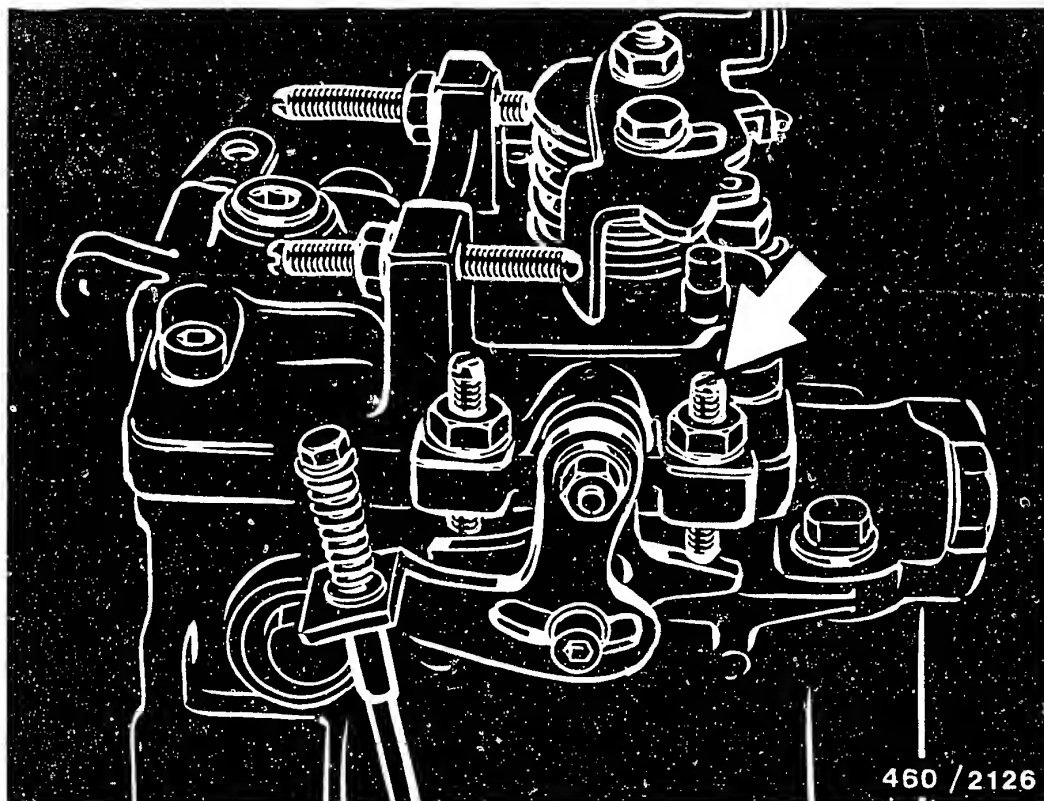
Set idle speed at adjusting screw by turning linkage.

Idle speeds, engine 1.6 L:
Audi 80/Audi 90 as of Model 87

Naturally aspirated diesel	850...900 min ⁻¹
Turbo Diesel	920...980 min ⁻¹
Turbo Diesel with charge cooling	Code letters "RA" 870...930 min ⁻¹

VW Passat as of model 88

Turbo Diesel 870...930 min⁻¹
Position idle stop screw such that it is in contact with LFG stop lever and lock.

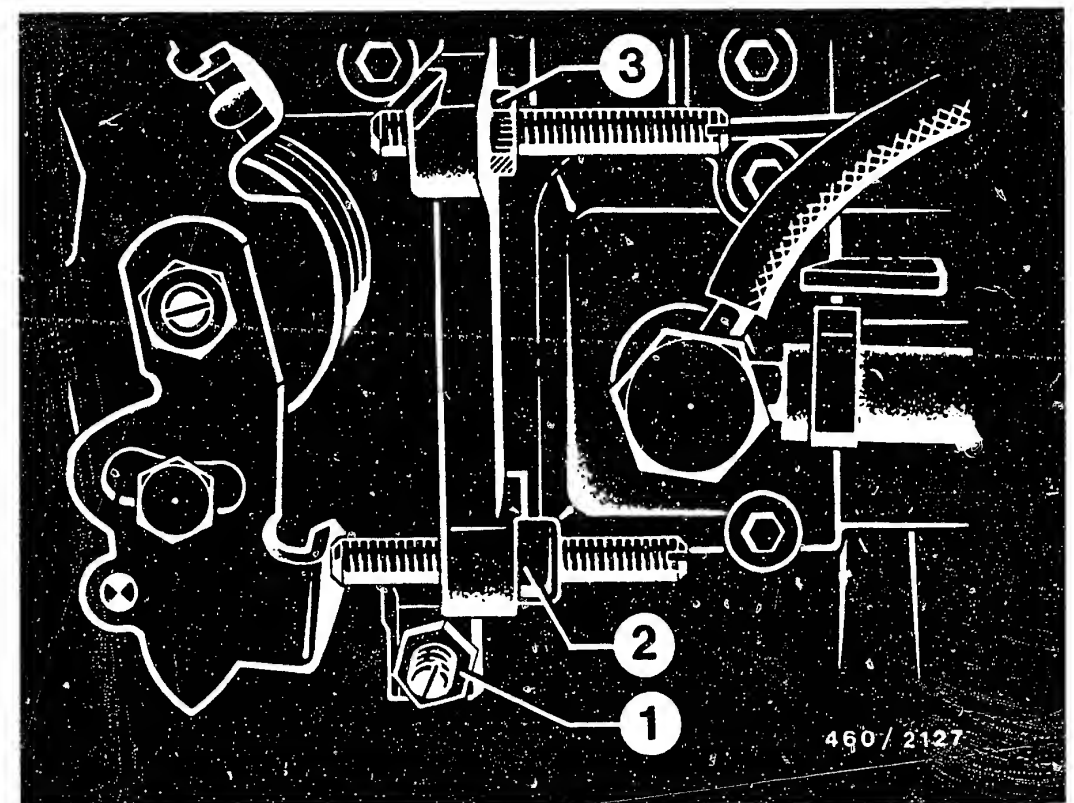


Arrow = Stop screw for high idle

SETTING SPEED INCREASE

Loosen stop screw for high idle.

With KSB cable completely pulled out, set high idle to 1050 min^{-1} by turning stop screw.



- 1 = Idle-speed adjusting screw
- 2 = Residual-quantity adjusting screw
- 3 = Rated-speed adjusting screw

TESTING AND ADJUSTING IDLE SPEED

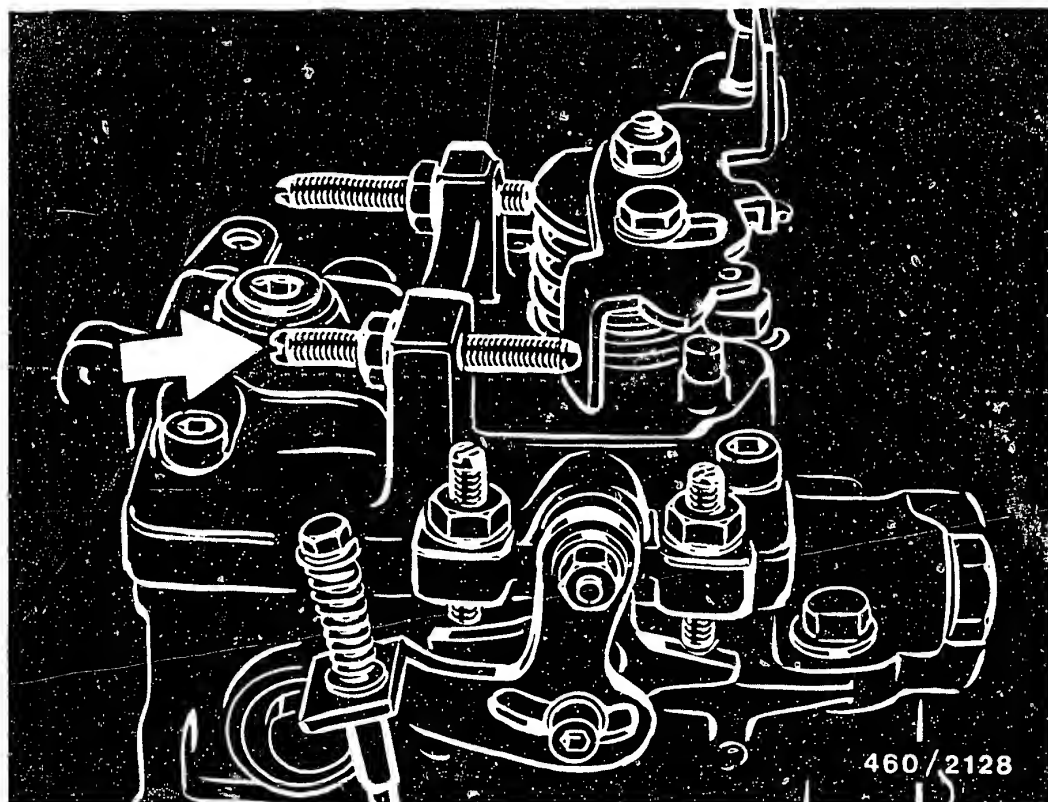
Engine 1.3 L

Testing and adjustment conditions:

- * Engine oil temperature min. 60°C
- * Cable of cold-start accelerator must not have been pulled.
- * Electrical loads off

Start engine and run it at idle speed.
Set engine speed at idle-speed adjusting screw.

Idle speed:
Naturally aspirated diesel $850 \dots 950 \text{ min}^{-1}$



Arrow = Residual-quantity adjusting screw

TESTING AND ADJUSTING RESIDUAL QUANTITY

The residual-quantity adjusting screw is secured with a cap and is not normally to be adjusted.

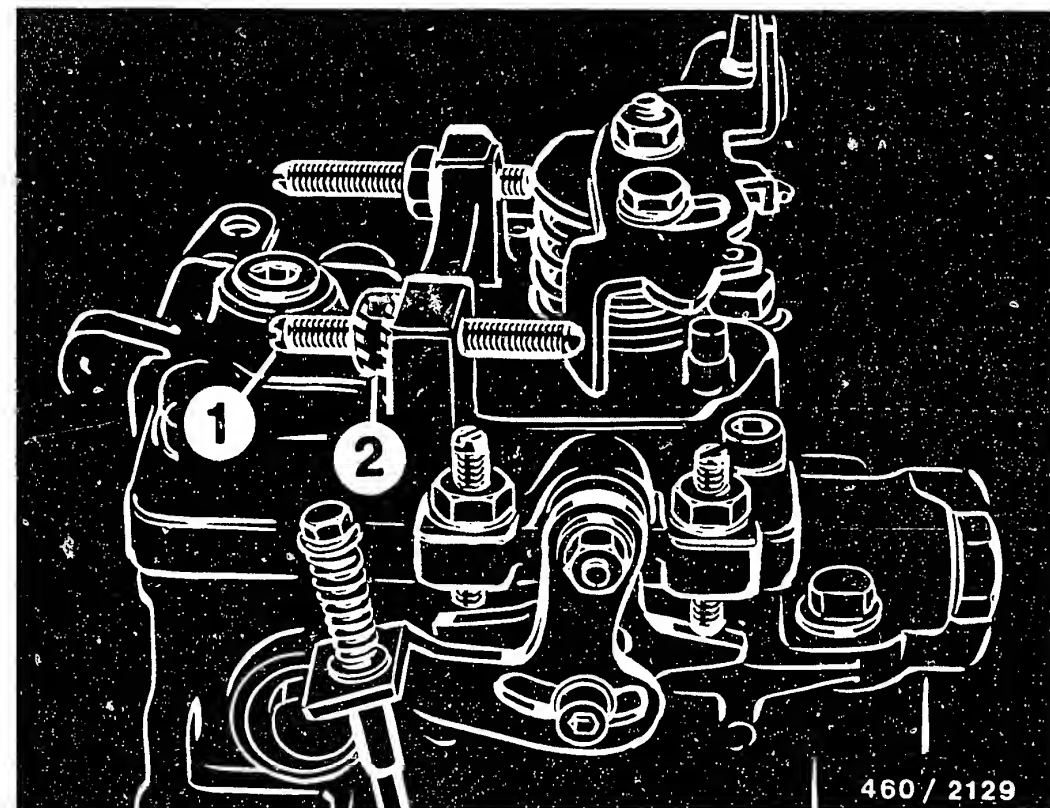
The following "complaints" may be encountered if the residual-quantity adjusting screw has been turned:

Residual-quantity adjusting screw screwed in:

- * Residual quantity too large - speed too high and idle setting not possible.

Residual-quantity adjusting screw screwed out:

- * Residual quantity too low - poor throttle take-up on starting off and acceleration from low speed or bucking in all gears.



1 = Residual-quantity adjusting screw

2 = Securing cap

Residual-quantity correction

Residual quantity too small:

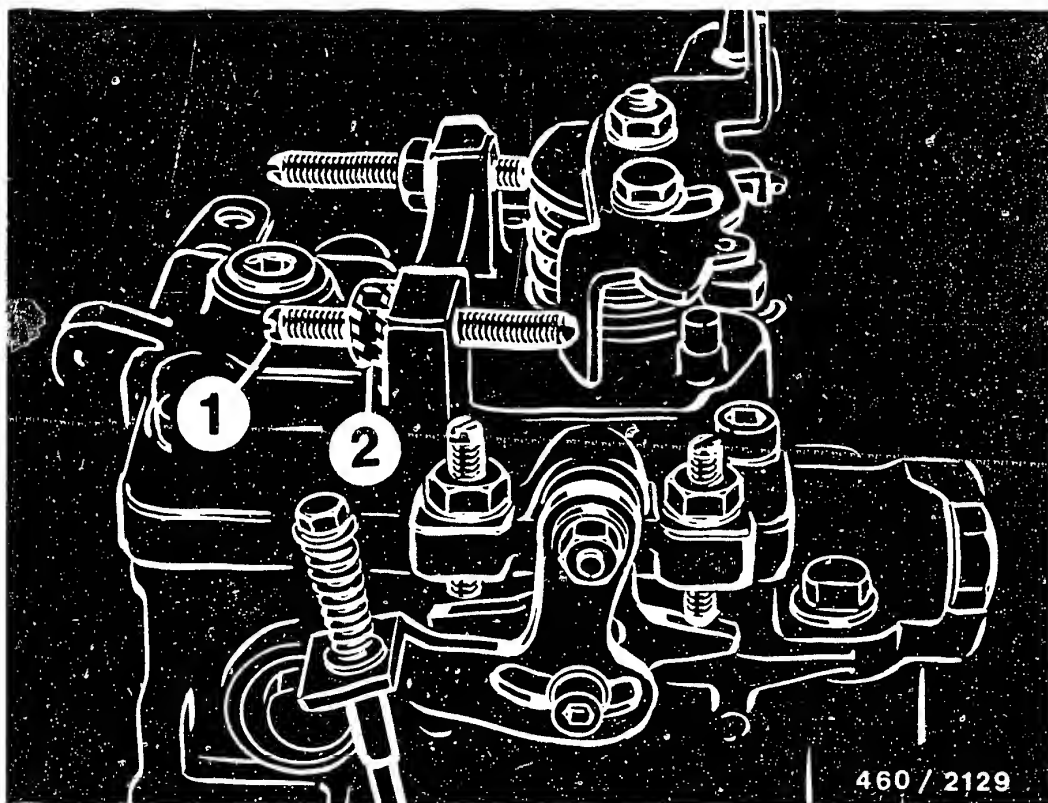
Remove securing cap.

Loosen lock nut on residual-quantity adjusting screw.

Screw in residual-quantity adjusting screw until there is a slight increase in idle speed.

Turn back residual-quantity adjusting screw by half a turn.

Lock adjusting screw and secure with new cap.



- 1 = Residual-quantity adjusting screw
- 2 = Securing cap

Residual quantity too large:

* Idle speed too high

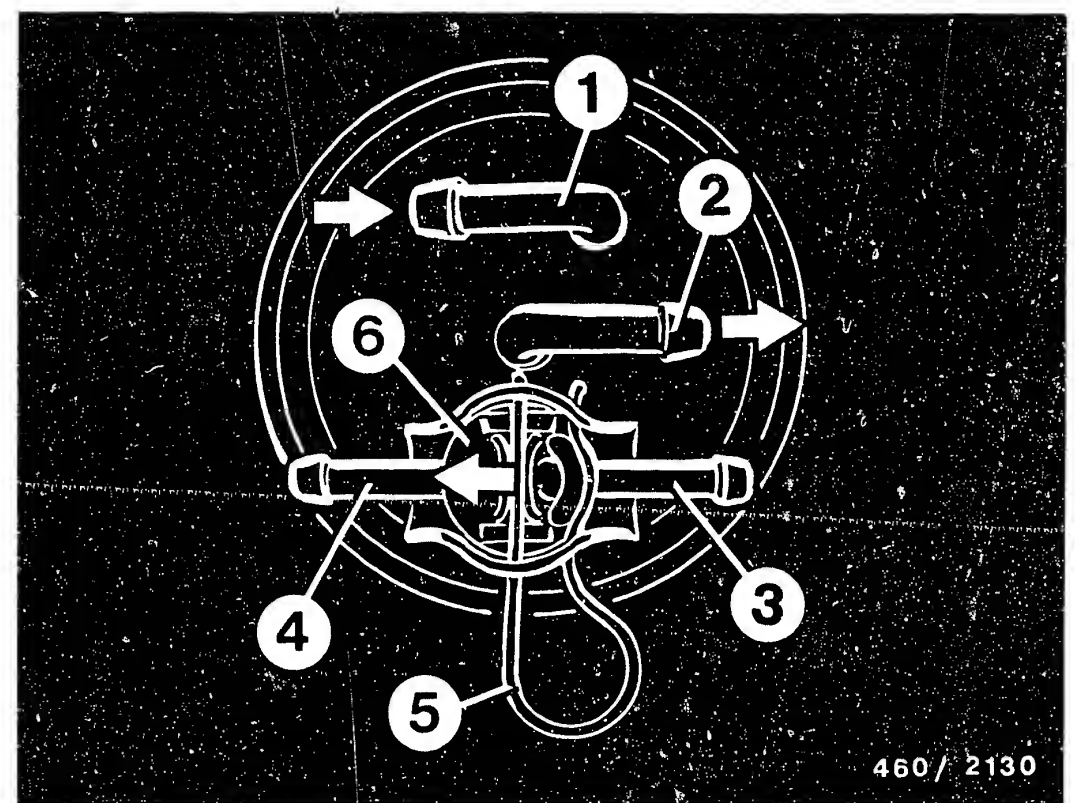
Remove securing cap.
Loosen lock nut of residual-quantity adjusting screw.

Screw out residual-quantity adjusting screw until there is no further change in idle speed.

Screw in adjusting screw again until there is a slight change in idle speed.

Turn back residual-quantity adjusting screw by half a turn.

Lock adjusting screw and secure with new cap.



- 1 = Supply line from fuel tank
- 2 = Supply line to fuel-injection pump
- 3 = Return line from fuel-injection pump
- 4 = Return line to fuel tank (marked with arrow)
- 5 = Clip
- 6 = Control valve

DIESEL-FUEL-FILTER PREHEATING

* Installation instructions on changing filter

When changing filter, remove clip and detach control valve with connected fuel line.

Fit new O-ring and install control valve as shown.
Secure with clip.

If control valve is damaged on installation, the engine will start following installation, but no fuel will be drawn in.

Fit new control valve.

Trouble-shooting instructions : CIT-5005

BOSCH system : Electronically controlled diesel
fuel injection
(EDC = Electronic Diesel Control)

Make of vehicle : CITROEN

Basic microcard : FZD-00..

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SPECIAL FEATURES

These brief instructions, valid at the time of publication, apply to the following Citroen model:

CITROEN CX 25 Turbo Diesel 2
with electronically controlled diesel
fuel injection (EDC = Electronic Diesel Control)

Engine: M 25/671, 78 kW
CH, A 03.87 ->

STRUCTURE, USAGE

These brief instructions essentially comprise vehicle-specific special features and test specifications (set values).

In line with the customer complaint, the trouble-shooting chart leads to various causes/component faults.

Detailed trouble-shooting information is to be taken from the basic instructions by way of the trouble-shooting chart.

NOTE:

The set values, terminal assignments and special features indicated in these vehicle-specific brief instructions are always binding even if reference is made to basic instructions.

SAFETY AND PRECAUTIONARY MEASURES

Pay attention to the information given in the basic instructions, so as to preclude injury to people and to prevent damage to engine, trigger boxes, control units and peripheral components of the EDC.

6

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

1.	Diagnosis lamp lights up/flashes
2.	Starting motor operates, engine fails to start or starts only with difficulty (hot and cold)
3.	Engine hunts when idling
4.	Idle out-of-round with warm engine
5.	High fuel consumption in conjunction with inadequate engine power and smoke formation
6.	Unsatisfactory performance
7.	Black fumes in full-load range coupled with hard engine running, possible loss of power
8.	Hard engine running
Cause (component fault)	
*	Self-diagnosis
*	Control-unit supply
*	Injected-quantity adjuster
*	Control-collar travel sensor
*	ELAB
*	Computer monitoring
	* Solenoid valve - start of injection
	* Electropneumatic pressure transducer (EGR)
	* Nozzle-holder assembly with needle-motion sensor
	* Computer connection
	* Engine-speed sensor
*	Engine-speed sensor and needle-motion sensor
*	Tank empty, tank ventilation
*	* Injection sequence not firing sequence

6

TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

1.	Diagnosis lamp lights up/flashes
2.	Starting motor operates, engine fails to start or starts only with difficulty (hot and cold)
3.	Engine hunts when idling
4.	Idle out-of-round with warm engine
5.	High fuel consumption in conjunction with inadequate engine power and smoke formation
6.	Unsatisfactory performance
7.	Black fumes in full-load range coupled with hard engine running, possible loss of power
8.	Hard engine running
Cause (component fault)	
	* Hollow screws, supply/return
*	* Air in fuel system
*	Paraffin separation
*	* Leak in fuel lines
*	Supply lines clogged
*	* * * * * Injection nozzle
*	* * * * Pump/engine assignment
*	Fuel filter
*	Glow plug system
*	* * * Engine compression
*	* * * * * Fuel-injection pump
	* Engine air filter
	* Engine control
	* Timing device
	* Turbocharger

TROUBLE-SHOOTING CHART (continued)

Customer complaint (fault symptoms)

9. Engine missing when driving
10. Engine switches off automatically
11. Engine runs at constant speed
12. Engine does not rev up when cold
13. Increased idle or engine does not run smoothly at high speed
14. Black fumes in full-load range
15. Cloud of fumes in full-load range (white)

Cause (component fault)

*	*				Accelerator-pedal sensor
*					Injected-quantity adjuster
*		*			Control-collar travel sensor
*					Computer monitoring
*					Engine-speed sensor and needle-motion sensor
*	*	*		*	Tank empty, tank ventilation
*		*		*	Injection sequence not firing sequence
*		*		*	Hollow screws, supply/return
*		*		*	Air in fuel system
		*			Paraffin separation
*					Leak in fuel lines
*		*		*	Supply lines clogged
		*		*	Pump/engine assignment
		*		*	Fuel filter
		*			Engine compression
		*		*	Fuel-injection pump
			*		Exhaust-gas recirculation
*					Water-level sensor

TROUBLE-SHOOTING CHART

Customer complaint (fault symptoms)

16. No exhaust gas recirculation function
17. Black fumes in full-load range coupled with hard engine running, possible loss of power
18. Starting motor operates, engine fails to start or starts only with difficulty (cold or warm)
19. No fault storage

Cause (component fault)

*					Computer monitoring
*					Solenoid valve (start of injection)
*					Electropneumatic pressure transducer (EGR)
*					Nozzle-holder assembly with needle-motion sensor
*					Engine-speed sensor
*					Air-flow sensor
*					Temperature sensor (air)
*					Temperature sensor (coolant)
	*	*			EGR valve
			*		Switch (brake)

TROUBLE-SHOOTING

How to use the self-diagnosis

Trouble-shooting (testing) must always be commenced with self-diagnosis.

The diagnosis lamp lights up in position 2 of the key-operated switch.
Test the self-diagnosis if the diagnosis lamp does not light up after actuating the key-operated switch.

Always note down flashing-code output.

The stored faults are cleared if the voltage supply for the control units is interrupted.

Particular attention is to be paid to the following if a faulty function circuit is indicated:

- * Loose contacts at multiple plug connections
- * Dirty, pushed-back or corroded plug contacts
- * Breaks in leads where leads are kinked or pinched.

Note:

Always switch off ignition before detaching or attaching control-unit plugs.

SELF-DIAGNOSIS VIA FLASHING-CODE EVALUATION

By way of the flashing code, an integrated self-diagnosis system makes it possible to localize a faulty component or a faulty circuit. An indication is given by way of the indicator lamp in the instrument panel.

The diagnosis program is activated by briefly connecting terminal 3 of the diagnosis plug to ground using the flashing-code evaluation unit KDAW 9980.

The flashing-code output commences with the starting code 1.2 (= 1 flashing pulse - pause - 2 flashing pulses) and ends with the finishing code 1.1.

Flashing-code evaluation

1. Switch on ignition. Diagnosis lamp lights up.
2. The self-diagnosis must be stimulated for at least 1 second.
3. Starting code 1.2 is displayed.
4. Repeat stimulation:
 - a. The finishing code 1.1 is displayed if there is no fault
 - b. If faults are present, they are always indicated after each stimulation process. The finishing code 1.1 is displayed once all stored faults have been output.

Flashing-code reset

1. Move key-operated switch to position 2.
2. Press brake pedal and simultaneously stimulate self-diagnosis.
3. Call up self-diagnosis by way of renewed stimulation.
4. Initial code 1.2 and finishing code 1.1 must be displayed.

SELF-DIAGNOSIS TEST TABLE

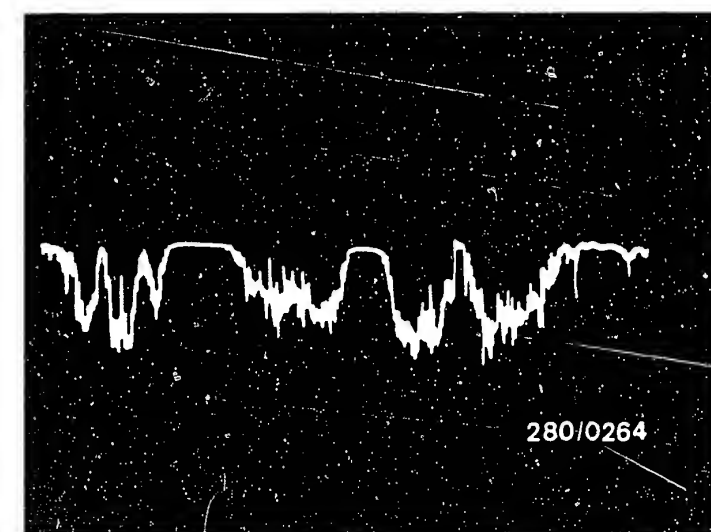
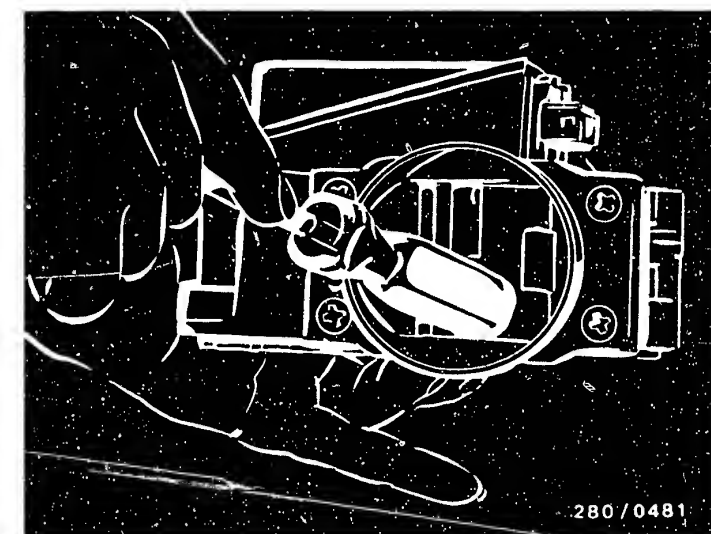
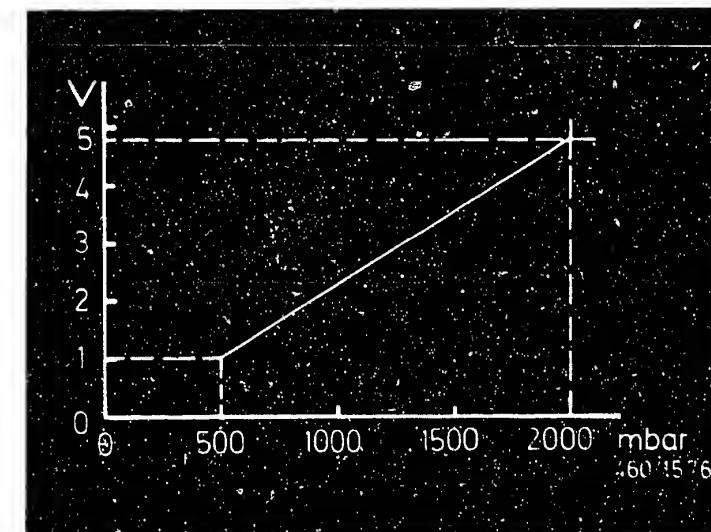
Fault indication Flashing code	Testing of component/function	Test instructions/Test conditions	Terminals	Set values
1.3	Temperature sensor (air)	Test resistance at air-flow sensor at 15...20°C, at approx. 80°C. Test voltage (control unit) at detached connector.	1 - 4 1 - 4	1300...3600 Ω 250...390 Ω Approx. 5 V
1.4	Temperature sensor (coolant)	Test resistance at component. 15...30°C: Approx. 80°C: Test voltage (control unit) at detached connector.		1300...3600 Ω 250...390 Ω Approx. 5 V
1.5	Temperature sensor (fuel)	Perform tests at 7-pole connector of EDC-VE pump using test adapter KDEP 1165 and adapter leads KDEP 1165/200 and -/201. * Short-circuit to ground Connect adapter to fuel-injection-pump connector * Short circuit Connect adapter to fuel-injection-pump connector * Internal resistance at 15...30°C: Connect adapter to fuel-injection-pump connector * Voltage (control unit): Connect adapter to control-unit connector	5-grd. 6-grd. 4 - 6 5 - 6 5 - 6	> 1 M Ω > 1 M Ω > 1 M Ω 1,2...4,0 k Ω 4.5...5.5 V
2.1	Accelerator-pedal sensor	Perform tests on component * Internal resistance * Supply voltage * Voltage signal - idle position - full-load position	1 - 3 1 - 3 (-) (+) 1 - 2 1 - 2	1,6...2,4 k Ω 4.5...5.5 V 0,41...0,6 V 3,5 ...5,2 V

SELF-DIAGNOSIS TEST TABLE (continued)

Fault indication Flashing code	Testing of component/function	Test instructions/Test conditions	Terminals	Set values
2.2	Control-collar travel sensor	<p>Perform tests at 7-pole connector of EDC-VE pump using test adapter KDEP 1165 and adapter leads KDEP 1165/200 and -201.</p> <p>* Short-circuit to ground Connect adapter to fuel-injection-pump connector</p> <p>* Short circuit Connect adapter to fuel-injection-pump connector</p> <p>* Resistance - potentiometer track Connect adapter to fuel-injection-pump connector.</p> <p>* Resistance - wiper track Connect adapter to fuel-injection-pump connector.</p> <p>* Supply voltage Connect adapter to control-unit connector.</p> <p>* Voltage signal Connect both connectors to adapter. Disconnect cable connection at needle-motion sensor</p> <p>* Attach connector to needle-motion sensor.</p>	<p>1-grd. 2-grd. 3-grd.</p> <p>2 - 7</p> <p>2 - 3</p> <p>1 - 3</p> <p>2 - 3 (+) (-)</p> <p>1 - 3</p>	<p>> 1 M Ω > 1 M Ω > 1 M Ω</p> <p>> 1 M Ω</p> <p>1,0...10,0 k Ω</p> <p>0,5... 5,0 k Ω</p> <p>4,5...5,5 V</p> <p>2,0... 2,3 V</p> <p>> > 3,0 V</p>
2.3	Injected-quantity adjuster	<p>* Short-circuit to ground Connect adapter to fuel-injection-pump connector.</p> <p>* Internal resistance Connect adapter to fuel-injection-pump connector.</p> <p>* Supply voltage Connect adapter to control-unit connector.</p>	<p>4-grd. 7-grd.</p> <p>4 - 7</p> <p>7-grd.</p>	<p>> 1 M Ω > 1 M Ω</p> <p>0,3... 1,2 Ω</p> <p>8,5...14,5 V</p>

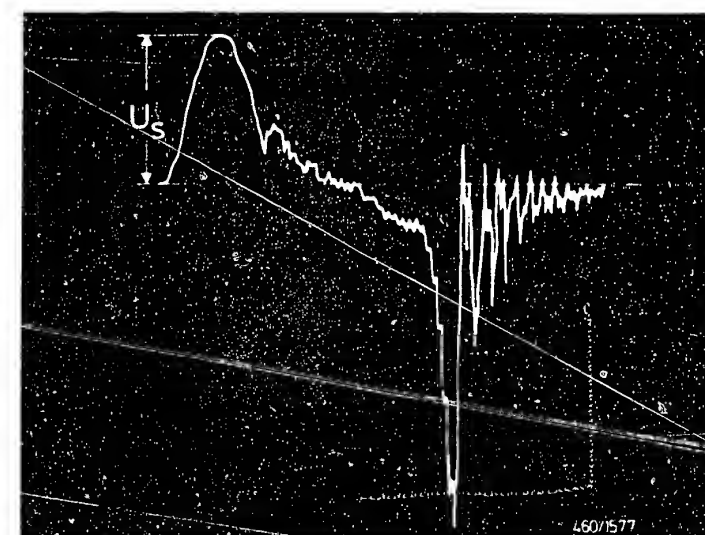
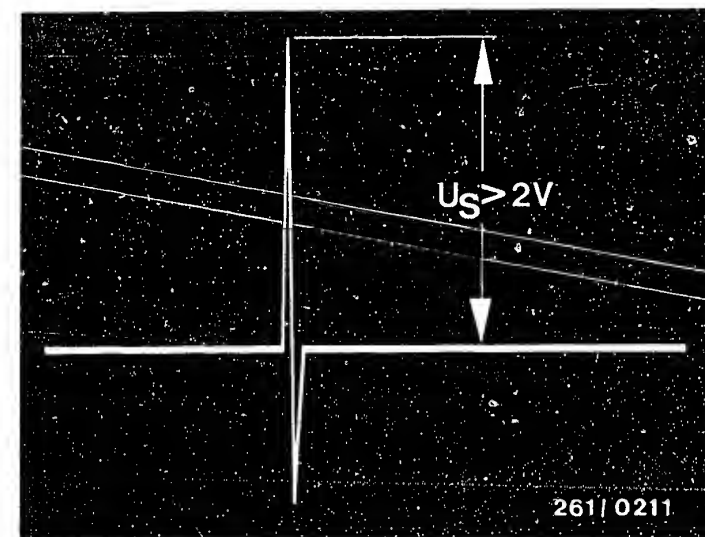
SELF-DIAGNOSIS TEST TABLE (continued)

Fault ind. Flash. code	Testing of component/function Test instructions/conditions	Terminals	Set values
3.1	Atmospheric pressure sensor. Perform test on component. * Supply voltage * Voltage signal (Determine barometer reading)	1 - 3 1 - 2	4.5...5.5 V See characteristic curve
3.3	Air-flow sensor. Perform tests on component. * Total resistance * Supply voltage * Voltage signal - By changing position of sensor flap of air-flow sensor * Noise test - Motortester, special input	3 - 4 3 - 4 (+) (-) 2 - 4 2 - 4	500...1000 Ω 4.5...5.5 V 0,25...4,65 V Noise signal with faulty air-flow sensor (see picture)
3.4	Pressure transducer - exhaust gas recirculation * Test internal resistance at component at 0...120°C * Test voltage (control unit) at connector component * Actuation on/off ratio - Coolant temperature approx. 80° C - Connect pocket tester to pressure transducer - Set dwell angle range - Allow engine to idle - Detach connector at temperature sensor (coolant) or air-flow sensor. Note: On/off ratio must change when one of the components is detached.	1-grd.	4.5...8.0 Ω Approx. 12 V Read off on/off ratio on tester 0... 10 %



SELF-DIAGNOSIS TEST TABLE (continued)

Fault indication Flashing code	Testing of component/ function Test instructions/conditions	Terminals	Set values
4.1	<p>Engine-speed sensor</p> <p>Perform tests at multiple butt connector of component.</p> <ul style="list-style-type: none"> * Short-circuit to ground * Internal resistance at approx. 20° C * Engine-speed signal pattern <ul style="list-style-type: none"> - Motortester, special input - Allow engine to idle <p>Note: Positive voltage peak must come first</p>	<p>1 - 2</p> <p>1 - 2 (+) (-)</p>	<p>> 1 M Ω</p> <p>900...1100 Ω</p> <p>see signal pattern</p>
4.2	<p>Perform needle-motion-sensor tests at multiple butt connector of component.</p> <ul style="list-style-type: none"> * Short-circuit to ground * Internal res. Approx. 20° C Approx. 80° C * Supply voltage <ul style="list-style-type: none"> - Multiple butt connector detached - Multiple butt connector attached at approx. 80°C * Needle lift signal/signal voltage (U_s) <ul style="list-style-type: none"> - Multiple butt connector attached - Allow engine to idle - Motortester, special input 		<p>> 1 M Ω</p> <p>90... 110 Ω 111... 135 Ω</p> <p>10,0...12,0V 2,5... 6,0V</p> <p>see signal pattern</p> <p>$U_s = > 150 \text{ mV}$</p>



SELF-DIAGNOSIS TEST TABLE (continued)

Fault indication Flashing code	Testing of component/function	Test instructions/Test conditions	Set values									
4.3	Solenoid valve (start of injection)	<p>Perform tests at multiple butt connector of component.</p> <ul style="list-style-type: none">* Short-circuit to ground* Internal resistance at approx. 60°C* Test voltage (control unit) at detached multiple butt connector.* Actuation on/off ratio<ul style="list-style-type: none">– Coolant temperature approx. 80°C– Connect pocket tester to connected multiple butt connector– Set dwell angle range– Allow engine to idle– Detach connector at needle-motion sensor <hr/> <ul style="list-style-type: none">– Attach connector to needle-motion sensor <p>Note: On/off ratio must change when needle-motion-sensor plug is detached or if engine speed is increased.</p>	<p>> 1 M Ω</p> <p>13,0...22,0 Ω</p> <p>Approx. 12 V</p> <p>10...30 %</p> <p>20...40 %</p>									
5.1	Computer connection Control unit (stored fault)	<p>Fault is n o t present when test is performed. Detach control-unit plugs 1 and 2.</p> <p>Check leads listed below for open-circuit/contact resistance:</p> <table><tr><td>Control-unit plug 1</td><td></td><td>Control-unit plug 2</td></tr><tr><td>Term. 14</td><td>to</td><td>Term. 9</td></tr><tr><td>Term. 15</td><td>to</td><td>Term. 12</td></tr></table>	Control-unit plug 1		Control-unit plug 2	Term. 14	to	Term. 9	Term. 15	to	Term. 12	Approx. 0 Ω
Control-unit plug 1		Control-unit plug 2										
Term. 14	to	Term. 9										
Term. 15	to	Term. 12										

SELF-DIAGNOSIS TEST TABLE (continued)

Fault indication Flashing code	Testing of component/function	Test instructions/Test conditions	Terminals	Set values
5.2	Computer connection Control unit (current fault)	Fault is present when test is performed. Detach control-unit plugs 1 and 2. Check leads listed below for open-circuit/contact resistance: Control-unit plug 1 Control-unit plug 2 Term. 14 to Term. 9 Term. 15 to Term. 12		Approx. 0 Ω
5.2	Computer monitoring control unit 1	Fault in computer monitoring only present if – with flashing code displayed – engine can not be started. Renew control unit 1.		
Permanently lit	Computer monitoring control unit 2	Indicator lamp of self-diagnosis permanently lit. No flashing code is displayed when test switch is activated. Exhaust-gas recirculation disconnected. Detach multiple butt connector from solenoid valve (start of injection). Test voltage (control unit) at multiple butt connector.		Approx. 12 V

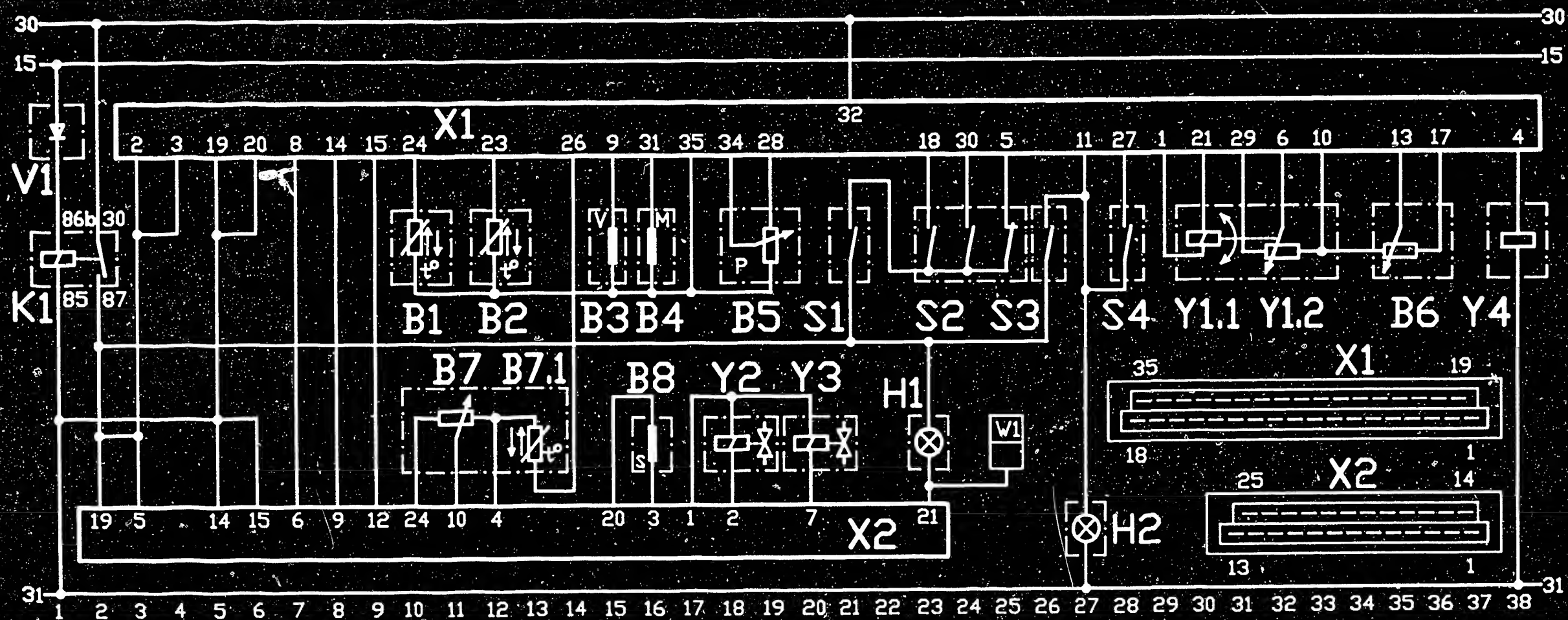
* * = Minor fault, diagnosis lamp goes out 30 seconds after starting engine.

TEST SPECIFICATIONS

Component/function	Set values
Idle speed:	
* Eng. at op. temp. (approx. +80°C)	750 min ⁻¹
* Cold engine	900 min ⁻¹
Nozzle opening pressure:	150 + 8 bar
Pump - engine assignment:	
Setting Engine setting	Cylinder No. 1 0.44 mm BTDC
Check value Engine setting	Cylinder No. 1 0.44...0.45 mm BTDC
Setting Pump setting	0.50 mm after BDC
Check value Pump setting	0.49...0.51 mm after BDC
Charge-air pressure:	0.8 bar at full load and 3900 min ⁻¹
Vacuum, vacuum pump	>350 mbar
Compression:	25...30 bar
Max. cylinder deviation	5 bar

TEST SPECIFICATIONS (CONTINUED)

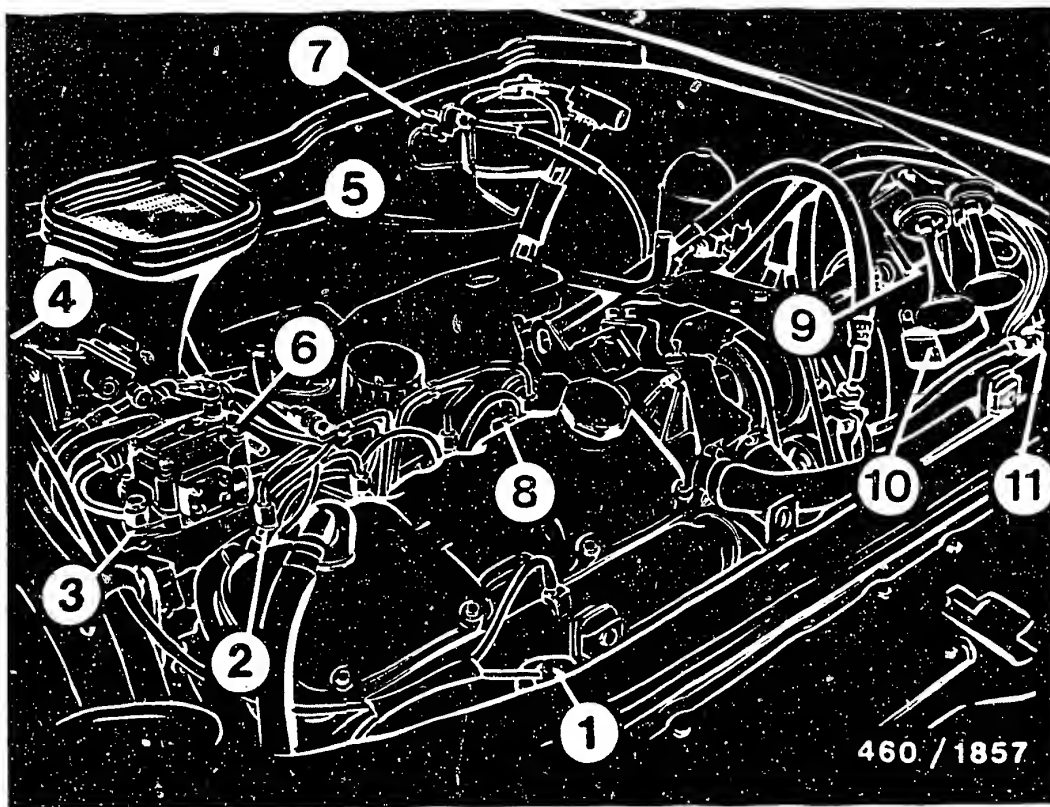
Component/function	Set values
Valve clearance - exhaust (cold)	0.20 mm
- inlet (cold)	0.30 mm
Filter test, max. perm. differential pressure:	0.3 bar
Pressure loss:	Max. perm. 25 %
Tightening torques	
Fuel lines	25 Nm
Fastening screws/ fuel-injection pump	20 Nm
Fastening screws/ nozzle-holder assembly	70 Nm
Sheathed-element glow plugs	25 Nm
Screw plug	15 Nm
Adjusting screw - rocker arm	15 Nm
Fastening nut/ fuel-injection-pump driving gear	45...50 Nm
Cylinder-head-cover bolts	7.5 Nm



460/1858

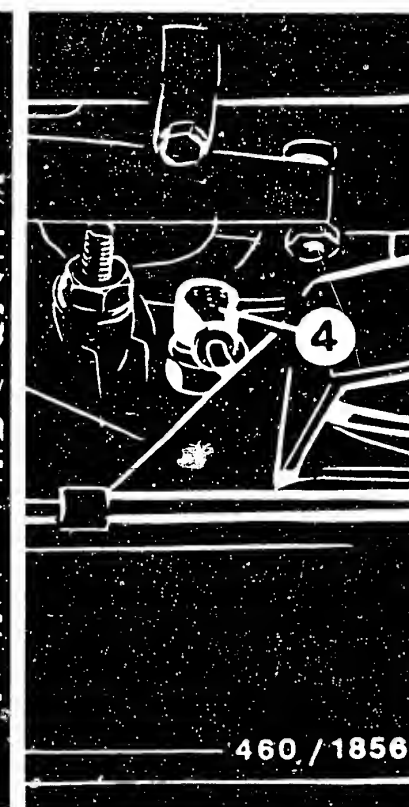
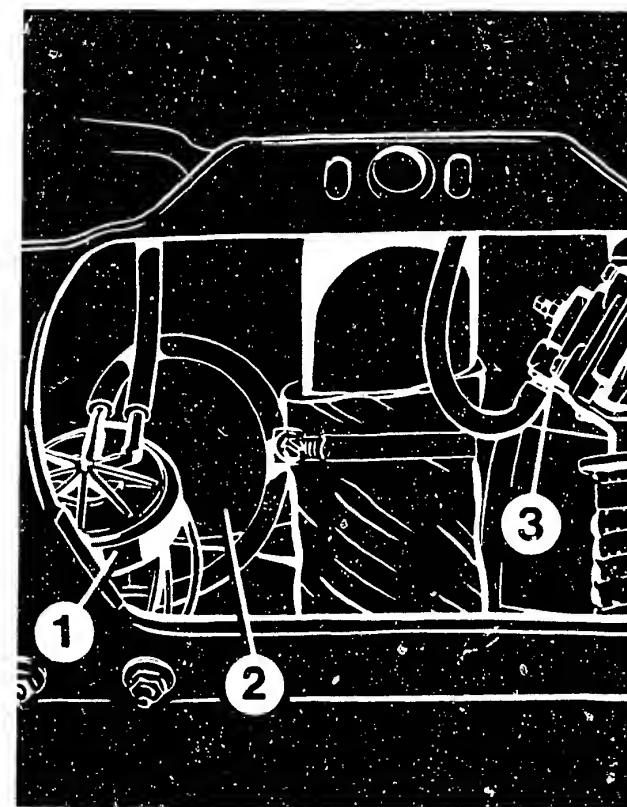
B1 = Temperature sensor (fuel)
 B2 = Temperature sensor (coolant)
 B3 = Road-speed pickup
 B4 = Engine-speed sensor
 B5 = Atmospheric pressure sensor
 B6 = Accelerator-pedal sensor
 B7 = Air-flow sensor
 B7.1 = Temperature sensor (air)
 B8 = Needle-motion sensor
 H1 = Diagnosis display
 H2 = Brake lights
 K1 = Reversed-polarity protection relay
 K2 = Solenoid-operated shutoff device (ELAB)
 ELECTRICAL TERMINAL DIAGRAM

S1 = Switch (road-speed regulation)
 S2 = Operating element (road-speed regulation)
 S3 = Switch (clutch)
 S4 = Switch (brake)
 V1 = Reversed-polarity protection diode
 W1 = Diagnosis stimulation
 X1 = Control-unit plug 1
 X2 = Control-unit plug 2
 Y1 = Fuel-injection pump
 Y1.1 = Injected-quantity adjuster
 Y1.2 = Control-collar travel sensor
 Y2 = Solenoid valve (start of injection)
 Y3 = Electropneumatic pressure transducer (EGR)



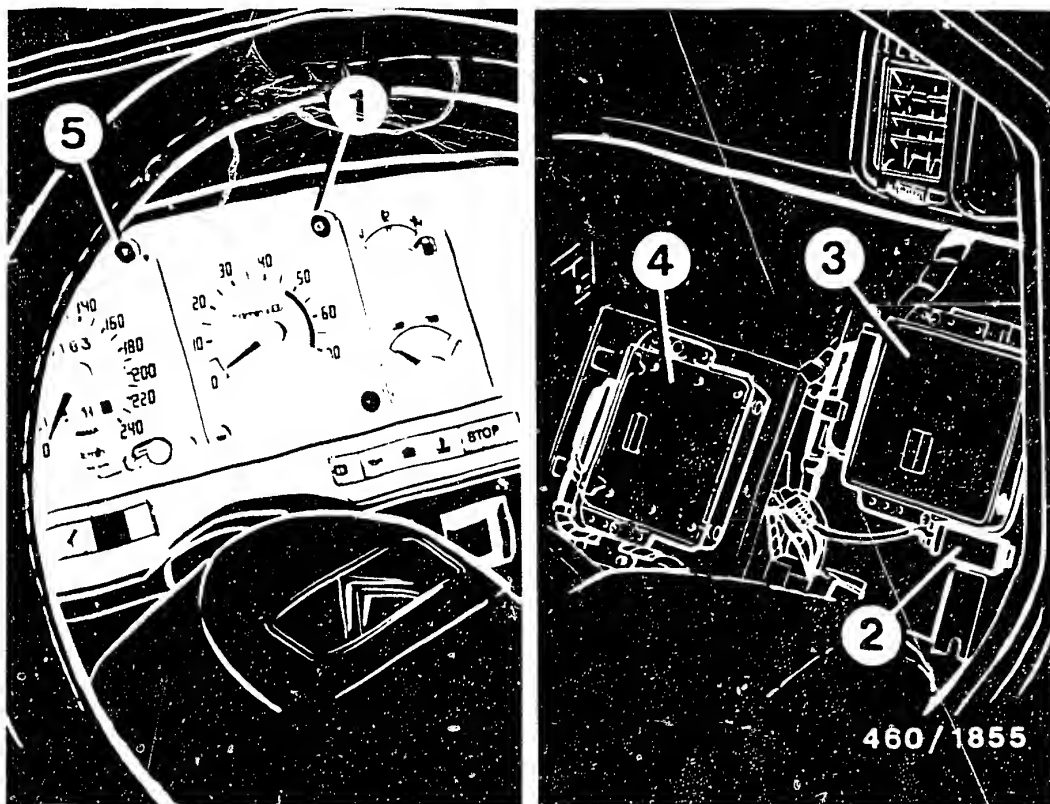
- 1 = Exhaust-gas recirculation valve
- 2 = Needle-motion sensor
- 3 = Fuel-injection pump
 - (-Injected-quantity adjuster, control-collar travel sensor and temperature sensor (fuel) are located in fuel-injection pump
 - Solenoid valve (start of injection) is attached
- 4 = Vacuum pump
- 5 = Atmospheric pressure sensor
- 6 = ELAB
- 7 = Road-speed pickup
- 8 = Temperature sensor (coolant)
- 9 = Accelerator-pedal sensor
- 10 = Glow-duration unit
- 11 = Diagnosis stimulation plug

INSTALLATION POSITION OF COMPONENTS



- 1 = Electropneumatic pressure transducer (EGR)
- 2 = Air-flow sensor with air filter
- 3 = Throttle-valve assembly
- 4 = Engine-speed sensor

INSTALLATION POSITION OF COMPONENTS (continued)



- 1 = Diagnosis indicator lamp
- 2 = Reverse-polarity protection relay with reverse-polarity protection diode
- 3 = Delivery and road-speed control unit (designated control unit 1 and control-unit plug 1 in these trouble-shooting instructions)
Installation location: beneath glove compartment
- 4 = Start-of-delivery and EGR control unit (designated control unit 2 and control-unit plug 2 in these trouble-shooting instructions)
Installation location: passenger-side footrest
- 5 = Water-level-sensor display

For production reasons:
continued on the following
coordinate.

INSTALLATION POSITION OF COMPONENTS (continued)